The Electrical World.

VOL. XXX. NEW YORK, AUGUST 21, 1897. No. 8.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

253 Broadway, New York.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 929 Chestnut Street.

SUBSCRIPTION IN ADVANCE, ONE YEAR, $3.00,

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THE ELECTRICAL WORLD,

253 Broadway, New York.

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THE ACCIDENT AT PATERSON.

The singular accident which occurred at the Edison generating station in Paterson, N. J., last Saturday is described elsewhere in this issue. It appears that the cause was directly the result of a praiseworthy attempt on the part of the management of the station to obviate any delay that might be caused by the coal miners' strike which is now in progress. In order to avoid a possible suspension from this cause they had provided a large excess of coal and stored it in a pocket in their station. The breakage of this under the unusual strain caused the accident, and resulted in a complete shutdown of the station for over twenty-four hours.

Accidents of this kind are a valuable source of information for electricians, since they teach what to avoid in the construction of stations. It seems that this particular catastrophe was primarily due to the structural weakness of the ironwork of the coal pocket, but it seems also that it points to a defect in the planning of the station itself, since a different disposition of the coal storage would have made the accident impossible.

It is not, however, from the accident itself that the most valuable experience is to be gained, but rather from the efforts which were immediately made to get the station into operative condition. Perhaps the most remarkable feature of this was the performance of one of the water-tube boilers, which was driven well above twice its rated capacity, and yet proved a satisfactory source of supply of steam during the emergency.

The celerity with which a temporary service was given is a remarkable illustration of the flexibility of electrical methods. No other system of supply from a central point, such as a gas works, water works, cable railway, or the like, could possibly have been even in partial operation within thirty-six hours after such a calamitous occurrence as that which wrecked the station in Paterson. The accident which has just happened, however, demonstrated in a way diametrically different from that furnished by the Philadelphia station fire some months ago the enormous importance of proper interconnection of the various power houses on an extended railway system. At Philadelphia the total destruction of a large railway power house only resulted in a few hours' delay to traffic, on account of the fact that six or seven other stations were connected with the scene of the disaster and were available as sources of power supply. At Paterson, however, the station is isolated, and was not able to make use of a supply of power from the several neighboring electric railway power houses, which might have been useful in such an emergency.

The principal moral of the Philadelphia fire was that it is not good engineering to put expensive machinery in an inflammable building. The conclusion to be drawn from the Paterson accident seems to be that the best place for boilers is not under a structure containing a thousand or so tons of coal.

PROGRESS IN ARC LIGHTING.

It is a singular fact that arc lighting, which was the first step in the progress of electrical illumination, has been until quite recently in a very backward state of development as compared with incandescent lighting and other applications of electricity. For over fifteen years the methods in vogue for arc lighting remained prac-

tically the same as at the beginning, in 1876. Improvements were made from time to time in the generating apparatus and in the lamps, but to all intents and purposes there was no novelty of any considerable importance introduced into the art of arc lighting until the appearance of the constant-potential circuit lamp some years ago. Following upon this the enclosed arc has opened an almost new field for this variety of illumination, and has proven of great importance and value. Still, to-day, in the greater number of stations, the methods of arc lighting in vogue in the early days of Weston Farmer and Brush are in use. The dynamos are relatively small and are belted to the prime movers. The whole appearance of the average arc-light station is crude, and suggestive of a neglect on the part of engineers and inventors.

There seems now, however, a considerable vitality in the field of arc lighting. Large dynamos of many circuits are an accomplished fact, and upon the successful construction of very large machines of this class arc lighting will take on entirely another phase. The desideratum is a machine which can be directly connected to a large engine, and which will supply many circuits of lamps without the necessity for dangerously high potentials in any of them. With the improvement of dynamo construction resulting from experience, and the invention of new details and methods, it has been possible to construct machines which are commercially satisfactory in their operation in sizes as large as 125 lights. This means a potential at the brushes of somewhere about 6300 volts, a pressure which is certainly not a comfortable one to handle. While the dynamos operate without much trouble at this voltage, still the dangers of such pressures upon wires in city thoroughfares and the elaborate precautions that have to be taken in connection with them are a source of constant annoyance and trouble to the station using such apparatus. It is to be hoped that we shall soon see large direct-connected units furnishing many circuits at reasonable pressures up to, say, 2000 volts.

In another column is an account of an interesting development for the use of rectified alternating currents for arc lighting. It will be remembered that this system, without the rectifying element of it, has already been tried, and has met with the same condemnation which has hitherto marked all efforts to utilize the alternating current in arc lamps. It is pleasant to be able to say that some of the most recent alternating lamps, however, have apparently obviated the various difficulties of noise and sputtering that seemed to harass the first comers in this field. With the rectified current furnished by the apparatus above referred to there ought not to be any trouble in using the ordinary forms of series-arc lamps, although it is likely their adjustments will have to be changed on account of the impedance of their pressure coils.

The arc light has a very large field, which has not been invaded in any degree by the incandescent lamp. Its future seems to be particularly bright, and it is to be hoped that the efforts of inventors will not be spared in the direction of its improvement. What are needed are large direct-connected generating units, better carbons, and some further elaborations of the present methods for the operation of enclosed arcs.

ELECTRICITY, STEAM OR COMPRESSED AIR?

At the time of writing the Manhattan Elevated Railway Company, of New York, has just begun to make tests of the Hardie compressed-air locomotive for the operation of its trains on the Sixth Avenue line. Considerable publicity has been given to this method of traction by these experiments, and some popular misconception exists as to the relative merits of the three methods of traction whose names form the title of this article.

It is difficult to estimate the relative advantages of different systems for street traction, but quite easy to compare air locomotives with steam locomotives, on account of their very great similarity. The mechanism of the air locomotive is practically identical with that of its predecessor, the steam machine. In the engine now under test air is used at 150 pounds pressure and expanded in cylinders linked to the driving wheels and controlled by reversing valve gear, similar to that used on the steam locomotive. The boiler is replaced by a bundle of steel flasks containing the compressed air, and combustion is utilized to reheat the air and warm the train. On account of the reciprocating action of its parts, the weight of the air locomotive is limited, for structural reasons, to that of the steam engine, which it attempts to replace. This would not be the case with an electric locomotive, which can be, if necessary, distributed throughout the train. The accelerating power of a steam locomotive is all that its adhesion will allow, and as this is equally true of the air locomotive, it is seen at once that under the limitations imposed by the structure upon which it works, it ean be no greater in the case of the air engine than it is now with the steam locomotive. In neither case is any use made of the load of passengers for adhesion purposes. The puffing exhaust and jerky starting are noticeable features of both systems.

The reliability of operation is even less with compressed air than with steam, on account of the dependence of the air locomotive upon its charging station, and the short interval of about two hours to which the operation of the machine is limited. With the same factor of safety, the danger of explosion with steam or compressed air is probably about the same. The smoke, ash, steam and noise nuisances are reduced, but not eliminated, by the use of the new motor.

Concerning economy, it may be said that the Manhattan steam locomotives use approximately 6 pounds of good anthracite coal per indicated horse-power hour. The Corliss compressor engine used with the air machine consumes 2 pounds of coal, but against this must be put the enormous losses due to heating the air during the compression, this heat being taken up by water jackets and thrown away. There is great loss also in the locomotive, where the pressure is throttled from 2000 to 150 pounds in a reducing valve, and the necessary increment of heat added by the reheating mechanism is by no means inconsiderable.

Comparing either of these methods with the electric locomotive, it is evident at once that the electric machine is more economical, gives greater acceleration, is more reliable and manageable, can utilize the load of passengers for adhesion, does not so rapidly disintegrate the structure upon which it runs, and receives its power from a power house where steam is used at high economy with the least possible loss in transmission. It is to be hoped that the result of the experiments with the air locomotive will be an even more complete demonstration of the great advantages of electric traction for this variety of work.

Definition of Science.

In an address at the opening of the meeting of the American Association for the Advancement of Science, at Detroit, Mich., August 9, Hon. Thomas W. Palmer gave a new definition of science. "Science," he said, "is the classification of phenomena to the end that general principles may be established and declared, from which rules of action may be deduced for application in particular cases."

Rectifiers for Arc Lighting.

There has been developed and put into commercial use in England an apparatus called the rectifier, which is practically unknown in this country.

Its purpose is the supplying of direct current to high-tension series arc circuits from a regular alternating current dynamo. By its use one or more independent series arc circuits may be fed from an alternating generator while the latter is simultaneously feeding an incandescent lighting system.

In construction, a rectifier consists simply of a reversing commutator, with suitable brushes provided with generous insulation, similar to that of an open coil arc commutator, which in fact, the rectifier closely resembles. The machine may be built with one pair of commutator segments, as indicated diagrammatically in Fig. 1, or with more. In case one pair is used, the rectifier must make

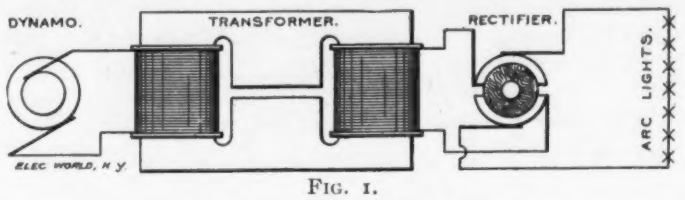


FIG. 1.

one rotation for each two periods of the alternating current. If more segments are used, the speed is correspondingly reduced. The rectifier may be driven by direct mechanical connection (coupling or gearing), with the shaft of the alternator, or by a synchronous motor supplied with current from the latter. The adjustment is such that the rectifier reverses the brush connections at the instant the alternating current reverses its direction of flow. This gives to the arc lamps a direct current with a wave form something like that shown in Fig. 2.

The effect on the rectifier of a change in the load of the alternator —especially a change in its vector component—changing the lag of the armature currents, depends on the mode of driving the rectifier. If the rectifier is mechanically driven, it will be thereby thrown out of phase, that is, it will not make its reversals at the proper in-

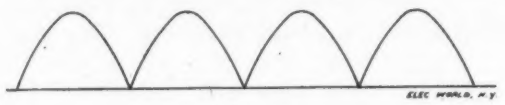


FIG. 2.

stant, or when the alternating current has an instantaneous value of zero. If, however, the rectifier is motor driven, the motor will follow the shifting of the alternator's output, and thus preserve a proper phase relation. If, on the contrary, the voltage of the alternator varies, the motor will shift out of phase, and thereby disturb the proper working of the rectifier, while a mechanical drive would not. Commercially, the motor-driven rectifier is preferred, probably because is can be run from any one of a battery of alternators. Obviously, one motor may run any desired number of rectifiers, the motor required being simply of sufficient power to overcome the friction of the apparatus.

To provide proper current regulation with changes of load on a series arc circuit, the rectifier is fed from what is called a constant current transformer, but might be more accurately termed a constant potential to constant current transformer. A transformer whose primary is supplied at constant potential, may be made without moving parts to give a fairly constant current from the secondary on all loads within its capacity, by constructing it for a low coefficient of mutual induction between primary and secondary; or, in other words, providing a large magnetic leakage. If the leakage is very large, the output of the transformer per pound of metal will be small and the primary currents will lag seriously. If the leakage is small, the regulation will be poor. A fair compromise between these opposing evils may be found. Better regulation, with a greater output, may be obtained from a transformer with an automatically adjustable leakage, somewhat on the principle of the Thompson-Houston balanced choking coil.

The leakage between the primary and secondary coils serves probably another purpose besides regulation.. It allows a certain amount of smoothing out of the pulsating wave form in the arc-light side without serious interference with the armature currents of the alternator. The amount of smoothing will depend upon the time constant of the arc circuit.

Rectifiers are now in regular use in ten English central stations and are being installed in several more. The papers and discussion on the subject of arc lighting at this year's meeting of the Municipal Electrical Association at Manchester, brought out much interesting information concerning them. Concerning the efficiency, that of a rectifier at Southport, carrying forty-three 15-ampere arc lamps, was given as 93 per cent. at full load and 87 per cent. at half load. This included losses in transformer and motor, but is open to a little doubt, as the fluctuating output was measured by an ammeter and voltmeter reading mean amperes and mean volts. The primary currents lagged to such an extent as to give a power-factor of 87 per cent. at full load and 45 per cent. at half load.

The saving of floor space with the use of large alternators and rectifiers instead of series arc machines was said to be considerable. Opinions on the general reliability of the apparatus were quite diverse, as is likely to be the case with any new apparatus. Some considered it very tricky, liable to flash over on any provocation, to pump badly and to break down. Attendance and repairs on the rectifier were generally considered small items.

Wherever it is desirable to distribute alternating current for incandescent lighting and high tension direct current for arc lighting, the use of the rectifier has evidently several advantages. It enables the power of the station to be generated in a few large direct conneted units instead of a large number of small belted machines. While the series arc machine requires a high voltage, dangerous to conduit insulation and to life, to carry even 100 lights on a generator, rectifiers will carry many hundreds of lights on one machine at a safe voltage. With large slow-speed steam alternators of medium frequency and rectifiers, the losses from engine shaft to arc circuit need not exceed 20 per cent. at full load, which is a better showing than most, if not all, series arc machines can make. The comparison at low loads is still more favorable to the rectifier. In small stations running one arc machine and one alternator the rectifier would appear to be an improvement, as it would enable a larger and more efficient alternator to do the work otherwise requiring two smaller and less efficient generators.

Between the rectified and the alternating current arc lamp, the advantage seems to be with the former, because of the somewhat higher lighting efficiency of the direct current lamp and the absence of a series alternating lamp.

Experiments in Fast Telegraphy in London.

A London dispatch, dated August 14, states that the Post Office officials there are deeply interested in the experiments in telegraphy made by Professor Crehore and Lieutenant Squier, whose system was described in THE ELECTRICAL WORLD in a recent issue. Messrs. Crehore and Squier are reported to have said that they went to England and asked the help of the Government to enable them to secure facilities for long-distance experiments with their system. M. W. H. Preece, of the Post Office Telegraph service, they say, was immediately interested in their scheme, and he promptly placed the Government plant at their disposal, and directed the subordinates to give them every possible advantage in the trials over the London and Birmingham line. It is stated that the tests have been entirely satisfactory, although the inventors themselves are reticent on this point. An impression seems to have been left on the minds of the British Post Office officials that the system is a valuable one, and may result in greatly cheapening telegrams. It is reported that Messrs. Crehore and Squier may go to France and Germany and exhibit the invention to the telegraph officials of those countries.

The Emancipation of the Steam Locomotive.

"Owing to the change of the motive power on the Lake Street Elevated Railway from steam to electricity, we offer for sale all the locomotives, simple and compound, standard gauge, owned by the line. None of them have had three years', and many of them less than two years' service." Thus begins a recent advertisement appearing in the *Manufacturers' Record*. The railway system whose power is to be changed, as above mentioned, is ordinarily known as the Alley Elevated Railway, and, as has been already noted, this road is to be equipped with the Sprague multiple unit system. The fact that these steam locomotives are already offered for sale certainly speaks well for the belief of those interested in the railroad system in the success of the new motive power.

The Accident at the Paterson Station.

A singular and peculiarly unfortunate accident occurred Saturday afternoon, August 14, in the Edison generating station at Paterson, N. J.

The station is of quite recent construction, and of a very thorough and perfect design. The intention of the management from its inception has been to have a model station. The output consists of high-tension series arc current, direct current at 230 volts for interior lighting, and power current at 500 volts, which the company supplies to the street railway companies on long time contracts. There is no other lighting or power station in the city of Paterson, which has about 100,000 population.

Pocket Plating Resting on Top of Boilers.

There are in the station nine vertical cross compound condensing engines of the Ball & Wood make, all but two of which are direct-connected to Edison multipolar generators. Their aggregate capacity is 5750 horse-power. Steam at 150 pounds pressure is supplied by a battery of six Sterling water-tube boilers rated at 435 horse-power each. Over the front of the boilers is a large V-shaped iron construction coal pocket, resting cantilever style on column-

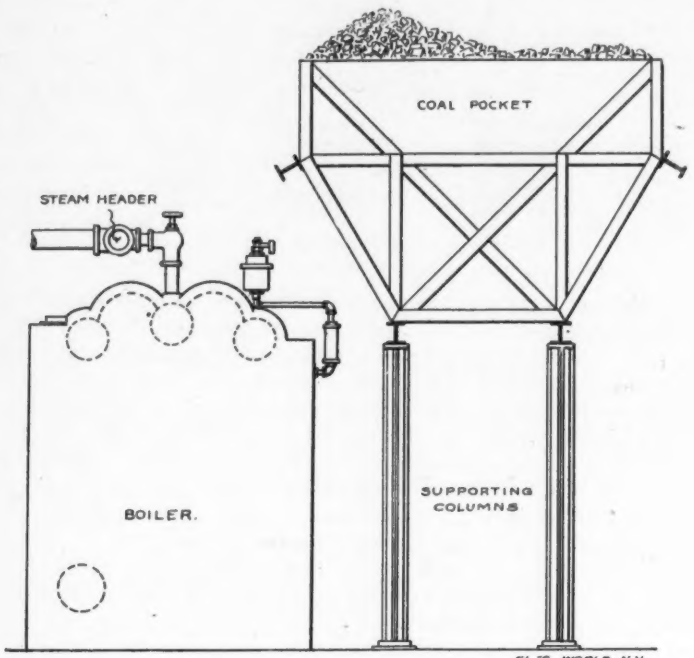
Top of Boilers and Steam Header.

supported I beams. This pocket is 32 feet wide, 20 feet deep and 105 feet long, and its base is 19 feet above the fire room floor. The sides of the pocket are tied together by angle iron diagonal trusses, as shown in the diagram, at intervals of 16 feet.

At 4:30 o'clock, August 14 (the pocket being filled with approximately 1000 tons of buckwheat anthracite coal), the right hand side of the pocket, as seen in the sketch, bulged out and broke, dumping hundreds of tons of coal on the floor below. Almost immediately the entire pocket, relieved of its load on one side, canted to the left and fell on the tops of the boilers. The result was a complete wreck of the main steam supply system.

The 14-inch steam header was ripped out, and a part of it was thrown to the floor below. The nozzle of every boiler was parted, steam drums were driven in, flanges cracked, safety-valves wrecked, and the system generally destroyed. In five minutes' time the 150 pounds of steam had escaped, making for itself a vent by bursting a section of the roof. A fair idea of the confusion may be obtained from the accompanying pictures, which were taken Monday, after two days had been spent in clearing up.

Fifteen minutes after the crash men were at work shoveling away



Sketch Showing Coal Pocket and Boilers.

the coal and running a new steam main. At 11:30 P. M. of the following day the arc lights of the town were re-lighted, one of the end boilers having been put into operation. In another twenty-four hours a temporary 8-inch header had been erected, and the other end boiler of the battery fired up. These two boilers will be obliged to carry the whole load for a week or ten days, while the intermediate ones, which were more seriously affected, are undergoing repairs. During the day, August 16, three of the 650-hp engines were running heavily loaded and supplied by the one 435-hp Sterling boiler, which was being fired like a blast furnace. No trouble was experienced from water in the steam or other causes. The output was over 1000 amperes on each side of the three-wire system, and approximately 1200 amperes at 550 volts.

American Steel Rails for Ireland.

A Cleveland, Ohio, dispatch states that President A. J. Moxham, of the Johnson Steel Company, who is now in England, has just secured orders for 20,000 tons of steel rails for electric roads in Ireland. This is probably the largest order of steel rails for electric-railway purposes ever shipped out of this country, and the fact that they are sent to the very doors of England is one of the notable features of the affair. Mr. Moxham has obtained a freight rate of $3 a ton from the works to Ireland. It will be necessary for the Johnson Company to build special rolls to do the work, and already work has been begun on them.

American Methods.

An Englishman, in a recent discussion in London, characterized as "the American way" of locating faults on low-tension wires the following method: "Discount every Sunday, earth one of the wires, and put on a 100-hp machine." He adds that he found it to be a most practical way.

Electric Motor-Cab Service in New York City—II.

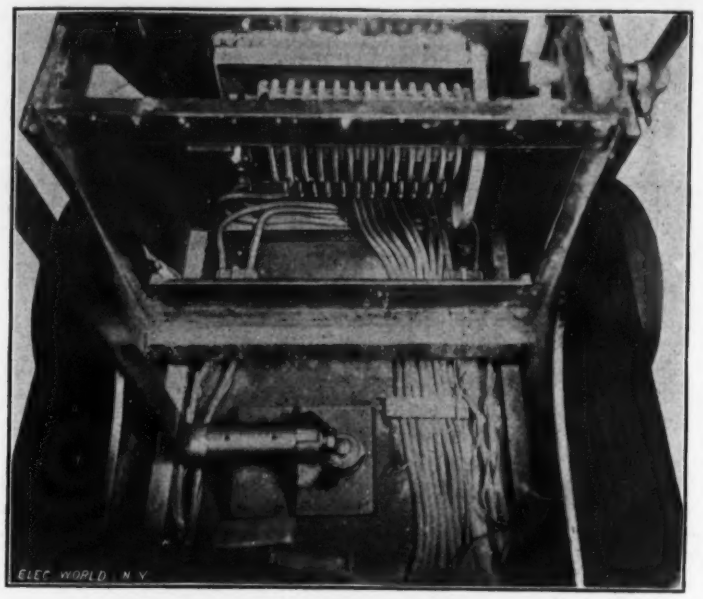
BATTERY EQUIPMENT.

IN choosing a battery for these electric hansom cabs, and, in fact, for all the other vehicles built by this concern, careful attention has been bestowed on various essential considerations. The necessity of limiting the battery to an amount just sufficient to accomplish the maximum distance required, owing to the relatively large proportion of battery to the total weight of vehicle, requires the use of a battery of the highest ampere-hour capacity and minimum weight. A reduction of the number of units in the battery is also advisable, as less care and attendance are certainly necessary when this is reduced to a minimum. If, however, a very small number of accumulators of relatively large size are used, the voltage will be correspondingly low, which would necessitate increased weight of apparatus for the same amount of energy. Another consideration which must not be lost sight of is the desirability of standardization. The usual potential employed on most direct current-distribution systems which would be available for battery charging, is 110 volts, and it is highly desirable to make the battery potential charging conform to this pressure, so that the introduction of rheostats and similar devices will not be necessary. It has been found that 800 pounds of battery, including retaining trays, jars, acid, etc., as arranged and used for these vehicles, will drive a ton weight 35 miles in four hours over ordinary city streets where grades are not excessive. Put in another way, it may be said that 100 pounds of battery will deliver 1-hp hour, and 2-hp hours will drive a ton at the rate of a little over 8 miles an hour. These are actual results and not calculations.

For the equipment of the hansom cabs forty-four cells of battery are used. These are arranged in four sets, each of eleven cells, each set being a separate unit retained in a single holding box or tray, having at each end on one side a contact strip connected with the batteries in that particular box, all of which are connected in series with each other. These trays are of sheet iron, measuring 20 x 13 x 6 inches, lead coated, and painted all over with acid-proof paint. Four such trays are placed in the previously mentioned battery box, forming the rear body of the vehicle proper. The rear end of this box body has a hinge door which opens downward. The batteries are therefore readily accessible, and can be easily taken out and replaced. The bottom of this box is divided longitudinally by a centrally placed double wooden partition, and the battery trays rest on rollers between the central partition and the side of the box body. The steering and brake rods and levers occupy the space between the two sides of this partition. The use of the rollers greatly facilitates the handling of the battery. In placing the battery within the vehicle all connections are automatically made, terminals at the side of the containing trays automatically coming in contact with corresponding plates attached to the side-supporting bars forming the bottom of the body.

Each of the elements has but three plates, For the cab service, the 3 F 100 ampere-hour cell is used, although the equipment also includes some 75 and 80 ampere-hour cells. For lighter service the 3 M type, having a capacity of 75 ampere hours, is used. These batteries are manufactured by the Electric Storage Battery Company. In some instances the cells consist of Manchester type plates, while in others chloride plates are used throughout. The complete battery equipment for a single hansom cab weighs about 900 pounds, has a normal discharge rate of about 21 amperes, and maintains 80 volts even at abnormally high rates of discharge. The use of three plates in each cell greatly facilitates and reduces renewals. All the elements of one set of eleven cells are solidly connected.

With the above battery equipment the following traveling capacities are possible: With the first speed of from 4 to 5 miles an hour the battery discharges at about 12½ amperes, and will last for a run of between 30 to 35 miles. The second speed of between 7 and 9



CONTROLLER, STEERING AND BRAKE LEVER ON HANSOMS.

miles per hour necessitates a battery discharge of about 25 amperes, and limits the run from 20 to 24 miles; and the third speed of about 15 miles an hour necessitates a discharge rate of about 40 amperes, and limits the traveling capacity to about 15 miles. The arrangement of the batteries and motors for these speeds will be described later. As will be readily understood, the voltage of the cells slightly decreases with the maximum discharge.

ELECTRICAL CONTROL.

In addition to the controlling devices which have already been noted, the steering and brake-operating levers, the actual operation of the motors and batteries, and their suitable action in order to produce the necessary speeds and direction of movement, is accomplished by means of a controlling cylinder placed inside of the raised driver's seat over the battery box. The spindle of this controlling cylinder projects through the side of the seat, and is fitted with an

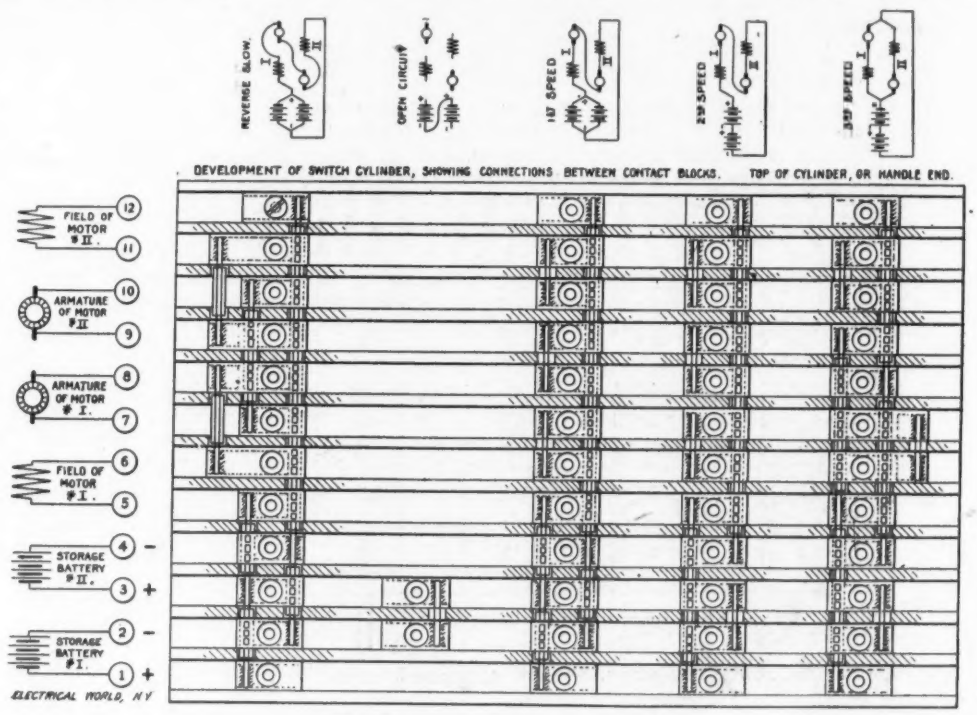


DIAGRAM OF CAB CONTROLLER.

upward-projecting handle at a right angle to the spindle. This controlling cylinder in general construction somewhat resembles a street-car controller, and is shown in the illustration. It consists of an insulating cylindrical support, having various sets of longitudinally arranged inter-connected contact blocks, each block being separated from the next by an annular-fibre insulating flange. Parallel with the axis of the cylinder is a row of contact brushes which form the terminals of the various battery sets and motor armatures and fields. These terminal brushes are all in line, and make contact with the blocks on the controlling cylinder. The controller

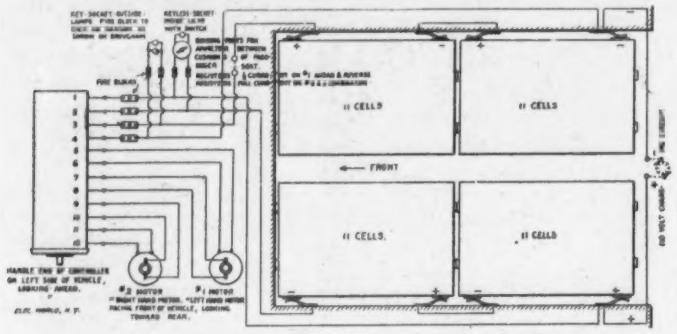
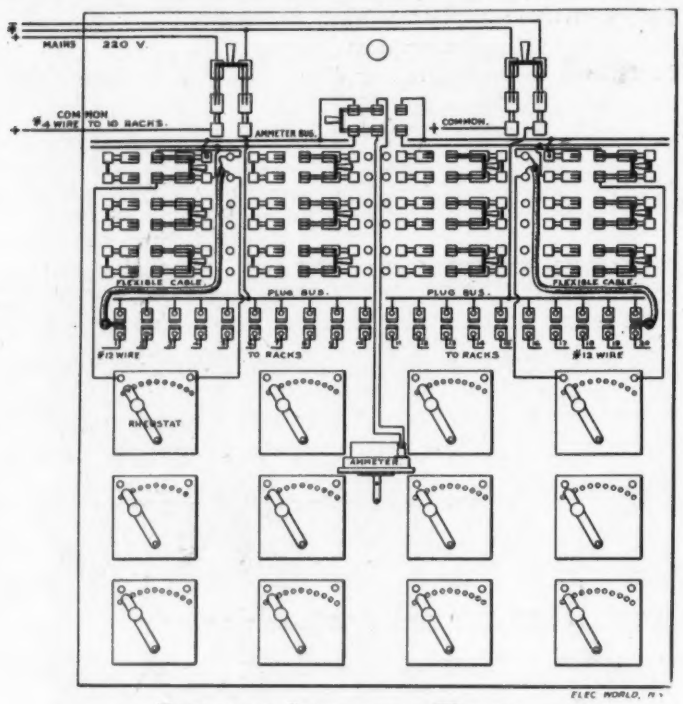


Diagram of Electrical Connections.

cylinder and contact brushes are placed horizontally. In addition to the actual controlling devices, an electric bell push is provided adjacent to the driver's seat, and also carriage lamps on each side of the fore body, as well as interior lamps. To produce the speeds already mentioned the batteries and motors are put through various series-parallel combinations. The controller is so arranged that for the forward movement of the vehicle three speeds are possible, while for the reverse only one. This reverse speed is at the rate of 4 to 5 miles per nour.

The sketch of the developed controller cylinder shows the interconnection of the various contact blocks and also the connections from the brush terminals to the batteries, fields and armatures. It will be noticed that the batteries are divided into two sets, each of

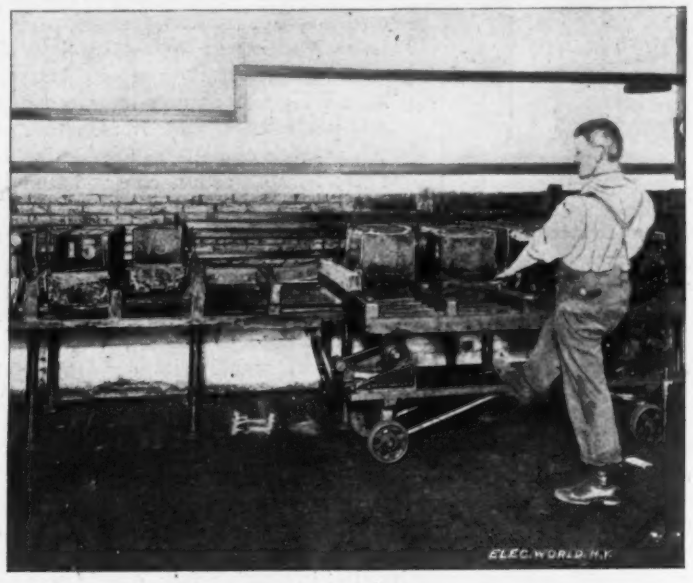


Details of Switchboard Wiring.

22 cells, each including two trays, and all connected respectively with the contact-brush terminals 1 and 2, 3 and 4. Then comes the field of one motor and its armature, and the armature of the next motor, followed by its field, which are connected with the terminals 5 and 6, 7 and 8, 9 and 10 and 11 and 12. On top of the cylinder are shown the various combinations effected by each step of the cylinder movement. The diagram will clearly show the connections and arrangements of the various apparatus, and requires no further explanation.

In the case of the surrey, the controller cylinder, although constructed on the same general lines, accomplishes a somewhat different combination of the various elements. It will be noticed in this case, instead of having a single field coil, the field winding of each motor is divided into two halves, which allows of a somewhat further combination, giving four speeds ahead with one reverse speed. It has been found that three or four speeds ahead with one reverse speed are ample.

In connecting and wiring from the batteries to the controlling cylinder and motors, the greatest simplicity of arrangement has been followed, and no extra devices have been introduced which



Battery Rack, Transfer Truck, and Method of Handling.

will in any way complicate the arrangement or necessitate any attention during the running of the vehicle. Automatic charging appliances, meters and switches have been entirely eliminated. The peculiar purpose for which these vehicles are intended, and the fact that they are in charge of men who are thoroughly familiar with the handling of such apparatus, has made it unnecessary to provide any such devices, which, were the vehicle to be handled by novices, might, however, be of service. At any rate, it must also be remembered that the battery has been so arranged and the cells disposed in such a manner that it is only necessary to bring the controller cylinder to its normal stop position, and connect the battery terminals as indicated in the sketch, with 110-volt charging terminals. A small resistance may be essential at the beginning of the charge.

By using the controlling cylinder with the diagram of connections the complete *modus operandi* will be readily apparent.

All the vehicles so far constructed and designed embody the same general features of operation and control as above described, with, perhaps, some detail modifications in the construction of the motor, suspension-controlling cylinder, etc. The previously mentioned surrey, or original "Electro-bat," has already been described in The Electrical World to some extent, and will probably need no further description here. The brougham here illustrated embodies some new features. In these vehicles the batteries, instead of being supported in a box on the rear main body, are immediately in front thereof, also under the driver's seat. They are handled in the same manner as the hansom batteries, through a door at the free end of the battery box, which in this case is in front of the vehicle. A similar arrangement of the batteries is also a feature of the delivery wagon and coaches. The 2-hp motors above mentioned are used on these vehicles.

CHARGING AND HANDLING THE BATTERIES.

Along the wall of the ground floor opposite the stored hansom cabs are the battery-charging racks. There are twenty of these, arranged side by side, each supported on iron posts. Each rack includes two transverse compartments which hold exactly the equipment of one hansom cab—forty-four cells in four trays. Each alternating-traverse cross-bar forms a rack partition, and on each side of these bars are slate slabs on which are mounted brass connecting strips. The bottom of each rack is made up of rubber-coated steel rollers arranged longitudinally between these bars, and a central rack-dividing bar in each rack. For handling batteries either

from the rack to the vehicle or vice versa, a battery cart or truck is used. This truck is mounted on low wheels, and has a table divided into four compartments, each of which accommodates a single tray of eleven cells. This platform rests upon inclined planes and is moved up and down thereon on rollers. A hand-wheel and screw-spindle arrangement at one end of the battery truck is used for raising or lowering the platform. This accommodates the level of the battery-carrying platform to either the battery rack or the battery box of the vehicle. This adjustable cart is essential, owing to the fact that when the batteries are removed from the vehicles a decreased weight on the pneumatic tires and springs causes a slight raising of the battery box.

The batteries in each single rack are connected exactly as if they were in the vehicle. That is, the four sets in each rack are connected in series. The entire battery equipment consists of 1144 cells, making 104 trays of eleven each, and twenty-six vehicle equipments, which is about 50 per cent. above that necessary for the present needs.

It is interesting to note that the current supply for battery-charging purposes is not taken from an independent dynamo plant. The peculiar availability of direct-current street service, and the fact that current for this purpose can be bought at a very reduced rate, has been greatly instrumental in the adoption of this method of current supply for charging purposes. An Edison three-wire service enters the building, mains from which are run back to the switchboard room, the same current being also used for light and power purposes. The charging switchboard is a unique affair, and embodies some novel arrangements, switches and rheostats. The board itself is a slab of 1½ in. thick slate, measuring 6 x 6 feet, and is mounted on angle-iron uprights. On this board are mounted a number of double and single-throw double-pole fused-knife switches, Carpenter enamel rheostats, spring-plug clips, flexible connection cables and plugs and a single ammeter. The arrangement of connections will be readily understood from the diagram.

Each side of the three-wire service is brought into one of the main double-pole single-throw switches at the top of the board. One side of each of these switches is connected to the end of a common plug clip bus bar, dividing the board in exact halves. The wire from the other side of each of the main switches extends back to the battery racks, where each of these common rack wires connects with ten battery racks, also one-half of the entire equipment. It will be noted that a wire from the other side of each of the plug clips extends to each respective battery rack.

In order to charge any particular rack of batteries, the plug at the end of the flexible cable, whose other end is connected to binding posts between the horizontally placed double-throw switches, is inserted in any one of the plug clips connected to the particular battery rack to be charged. It will be noted that each of these flexible cables, of which there are twelve—six on each half of the board—connect through the rheostat back to the one central blade of each horizontal double-throw switch, the other blade of which is connected to the other wire of the flexible cable. In charging, therefore, this switch is thrown either on short circuit to the left or to the right when the ammeter is brought into circuit, through the ammeter bus and switch, which is arranged to throw the ammeter on to the rheostat bus on either half of the board.

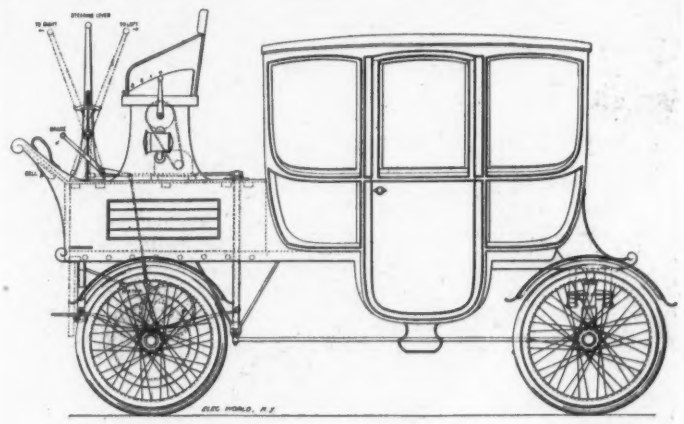
It will be noticed that while there are twenty battery racks, there are only twelve rheostats. It is found that this meets the average charging condition. The rheostats are used principally at the beginning of the charging, and are frequently entirely cut out by simply pulling the plugs out of the plug clips, and allowing the latter to connect across when the batteries are nearly fully charged. The amount of energy lost in the rheostats is exceedingly small, owing to this fact, as they are only used to take up the difference in voltage between the minimum and maximum charging points.

ELECTRIC BROUGHAM.

In addition to the fuses on the switchboard, each separate rack wire from the plug clips to the battery racks is separately fused at the back of the board. Altogether this arrangement of charging apparatus permits the handling of a very large amount of battery with a minimum of switch and controlling appliances. All the wires from the board to each respective battery rack are run in thoroughly waterproofed moulding, as well as the wires from the service to the board. Where the wires leave the moulding opposite each respective rack to make connection with the contact clips on the slate terminal boards of each rack, the wire is covered with rubber tubing, and laid on top of the crossbars between the slate contact-carrying slabs.

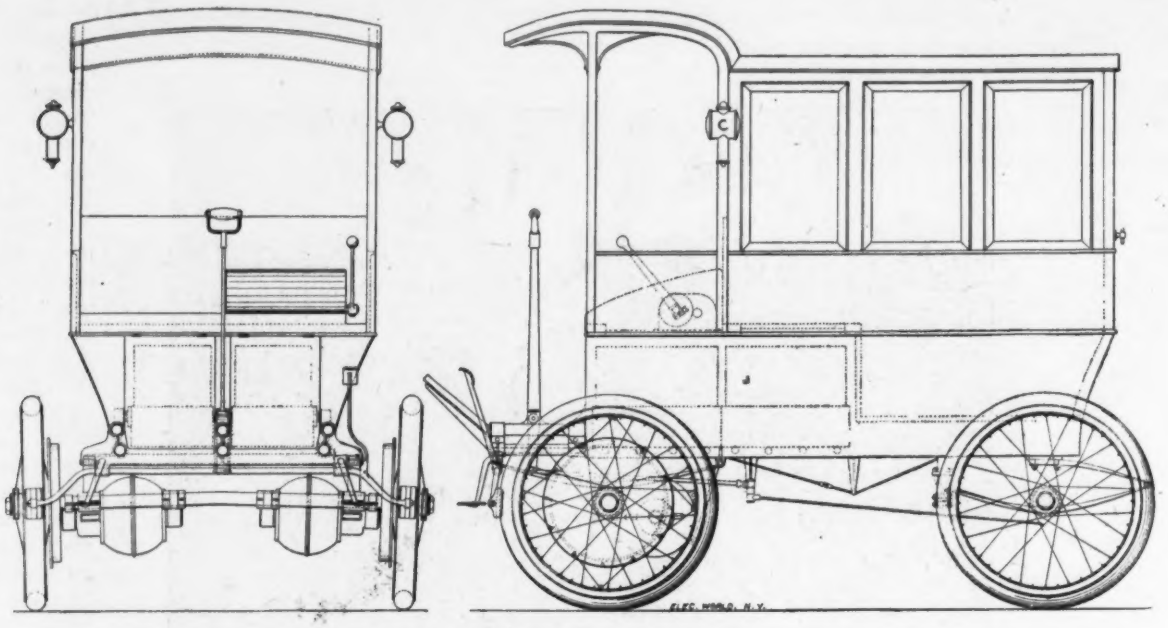
MAINTENANCE OF THE SERVICE AND STATION.

Aside from the mechanical and electrical side of this new enterprise, the business at the New York station is carried on in very much the same fashion as any regular cab service. The working force consists of the superintendent, Mr. C. J. Harrington, a starter, chief battery man, assistant battery man, machinist, washer and twelve drivers. The latter are uniformed in drab livery, and were ordinary cab drivers previously. They seem to take hold of the new vehicles very readily, appreciating their advantages, and at the pres-

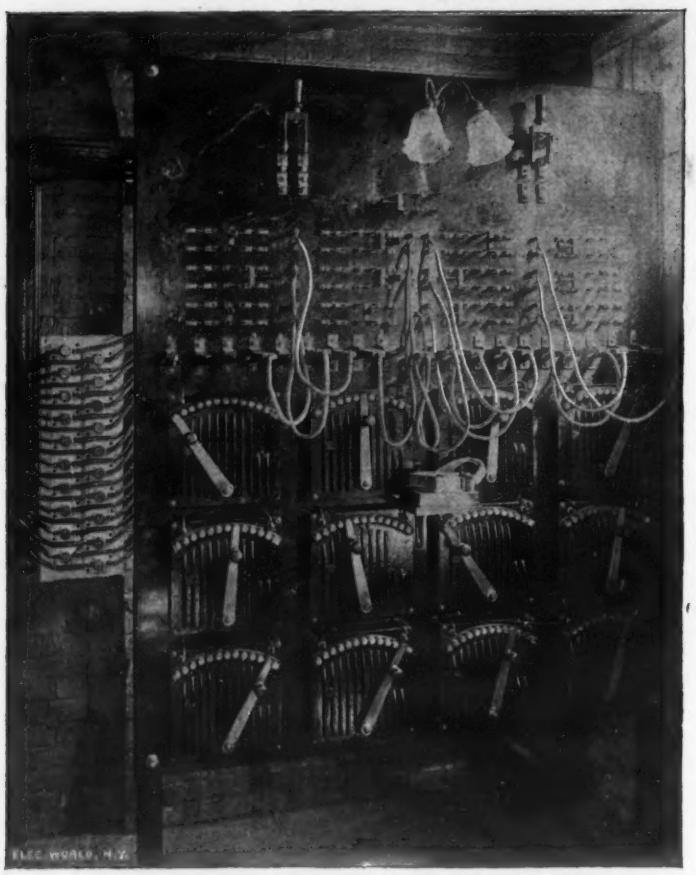


ELECTRIC COACH.

ent time are very expert in handling them. A number of vehicles are usually sent out to cab stations, but ordinarily the station is kept quite busy supplying the calls from hotels, clubs and even private residence for the electric-cab service. The charging of each of the vehicles, its washing, cleaning and overhauling, has now assumed a machine-like routine, and the men who have charge of each particular part of the work have become so expert that a cab can be gotten ready for service in a very small fraction of a minute. The arrangement for tire pumping may be noted. On the upper floor, as has been previously stated, an electric tire pump is located. From the accumulator of this pump a pipe line extends to the lower floor, where a flexible tube from this pipe extension can be connected to any of the tire valves. The pumping of the tire takes an almost inappreciable short time. All ordinary battery, motor and carriage repairs are made directly on the premises, and, as a whole, the station is entirely self-maintaining. The vehicles are usually recharged with a new set of batteries after they have traveled for 15 miles or more.



Electric Delivery Wagon.

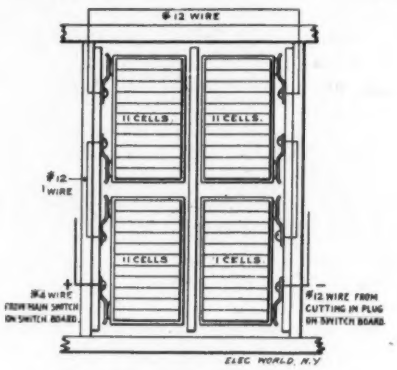


Charging Switchboard.

DOES IT PAY?

The main consideration of an enterprise of this kind, from a commercial standpoint, is whether it pays or not. Indications seem to show that even at the present stage the service is already on a paying basis. During the month of June a total number of about 632 calls were received, with a maximum of thirty-two and a minimum of twelve per day. One thousand five hundred and eighty passengers were carried a distance of 4603 miles. The rates are exactly similar to the horse-drawn cab rates, $1 being charged for the first two miles or any part thereof, and 50 cents for each extra mile. When taken by the hour for shopping and visiting, $1 is charged per hour.

The further development of this pioneer enterprise should be watched with close interest. Aside from the field open to the electric-motor vehicle in the hands of private individuals, the public use of such conveyances, under the control of those who understand their maintenance and operation, must unquestionably be crowned with success. Cheaper current production and improvements in the construction of the vehicles, batteries and motors, which will decrease the cost and increase their efficiency, will unquestionably permit of much lower rates, which is the much-desired goal for service of this kind. The operation of such stations will also broaden the field for private conveyances, as the electric motor cab or carriage station will certainly widen its usefulness by not only caring for its own vehicles, but also acting in the capacity of an electric-motor carriage livery station.

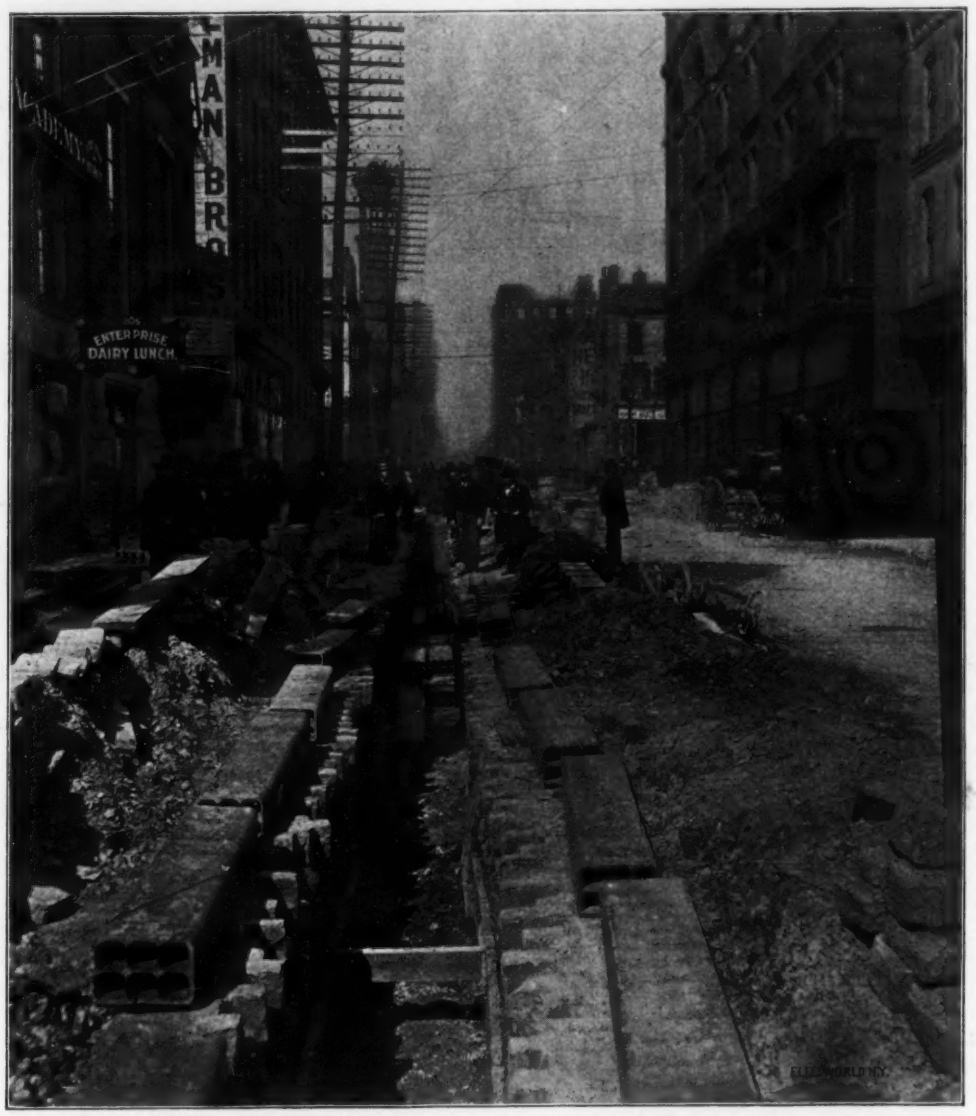


A Battery Rack and Contacts.

Conduit Construction in St. Louis.—I.

BY FRANK CLARK COSBY.

As most of the readers of THE ELECTRICAL WORLD are probably aware, St. Louis is one of the few large cities in the United States where overhead construction is still tolerated. The Municipal Assembly, however, fully appreciating this deformity in the appearance of the city, the constant menace to life and limb due to accidents which cannot be guarded against, the inconvenience and danger to firemen when fighting fire, and the unreliability of service due to sleet, wind storms, and cyclones, has recently passed an ordinance requiring all wires and cables to be placed underground in the congested district in the business centre of the city. This ordinance, known as No. 18,680, going into effect on September 8, 1896, upon being approved by the mayor, requires that all wires and cables shall be placed underground by December 31, 1898, in the district comprised between the river on the east, Wash Street on the north, Twenty-second Street on the west and Spruce Street on the south, an area of approximately 5 square miles, 1⅝ miles east and west and 3⅛ miles north and south. It does not affect the street railway companies, and permits overhead wires to be strung in the alleys. This ordinance, however, provides that only such companies as are at present doing business, or designate their intention of doing business prior to a specified date, are allowed to submit plans showing what space they may require, thus precluding all companies organized in the future from enjoying underground privileges. It also reserves the right to the city to purchase the conduits at the expiration of fifteen years, should it so desire, at a price to be fixed by a board of three arbitrators, and specifies how these are to be chosen. The Board of Public Improvements, under whose supervision and inspection the work has to be done, after carefully considering the many vexatious and difficult questions of all kinds involved, grades, curves, location of manholes, number of ducts to be laid, confliction with the present systems of gas, water and sewer mains, and the innumerable minor details that had to be looked after, finally notified the companies involved of their readiness to issue the necessary permits for tearing up the streets preparatory to beginning work; one of the rulings of the board being that, in spite of the comparative narrowness of the streets, the high-tension and low-tension circuits should be placed upon opposite sides, the high-tension—the light and power companies generally—taking the north side of streets running east and west, and the west side of streets running north and south, and the low-tension—the telegraph and telephone companies—the opposite sides of these streets. Before opening a street the companies are required to deposit with the City Treasurer the sum of $25 for each 75 feet of trench to be opened to insure the faithful performance of the work.



TRENCH WORK. LAYING SIX-DUCT AND TWO-DUCT CONDUIT.

It so happened that the different engineers of the various wire-using companies each decided that their interests would best be served by the use of a different style of conduit, so that the unusual opportunity is offered of comparing work done under exactly the same physical conditions, but involving the employment of nearly all the different types of conduit at present on the market, viz., the vitrified terra-cotta multiple duct conduit, single duct vitrified clay tile, wrought iron cement-lined pipe, and the ordinary iron pipe, and also some modifications of the above, as described later.

These styles of conduit are being put in by three different contracting firms, no two firms handling the same style, and for the purposes of this article, which is purely descriptive and based upon observation of the work being done, each firm and its style of duct will be treated separately, the multiple duct terra-cotta tile being first taken up.

For some time previous to the passage of the "underground ordinance," as it is termed, the formation of an independent telephone company was contemplated to compete with the local telephone company, the Bell Telephone Company of Missouri. This independent company was incorporated under the name of the Kinloch Telephone Company and is backed by some of the ablest and wealthiest business men of St. Louis. It has a capital of $1,500,000, to be used in the construction and equipment of a first-class modern telephone exchange, up to date in every particular; the service contemplated being that of a complete metallic circuit system. This company has had solicitors in the field for several months securing five-year contracts. At the present writing 5600 subscribers have signed these contracts, the terms being $60 a year for office telephones and $36 for residence telephones.

The contract for the installation of the complete exchange has been undertaken by the St. Louis Electric Construction Company, of which Mr. Hopkins J. Hanford is general manager and Mr. C. H. Ledlie, chief engineer. Work was begun by this company immediately after securing the necessary permits, and this early start undoubtedly meant a great saving of money and time, for it is readily understood that the earliest company in the field has the choice of location. Then, too, having its conduit in, when another company desires to cross its trench it is necessary to go under,

as the first company would naturally build as close to the surface as the Board of Public Improvements and good construction would permit. Such an early start was made that they had about 145,000 feet of duct laid before their contemporaries were ready to begin. At the present writing the manner of distribution or plan of reaching subscribers has not been made public by the engineers of this telephone company, but an inspection of the work under progress shows three principal lines of conduit running north and south in the prescribed district on Seventh Street, Ninth Street, and Eleventh Street. From Eleventh Street the conduits diverge to supply the western part of the city, and where possible are placed in alleys running east and west. From Seventh Street, to supply the business part of the city, the conduits branch out and are placed on alternate streets running east and west.

The conduit used by this company is a multiple duct vitrified clay conduit, and is manufactured by John T. McRoy, of Chicago. The order was for some 560,000 duct feet, about 475,000 feet of which has been received and laid. This tile was delivered in two, three, four and six-duct sections, the two latter sizes predominating, in carload lots of about 6000 duct feet each, all sections being six feet long. It is made of shale burned quite hard with an exterior and interior salt glazing, the former to exclude moisture and the latter to insure the easy drawing-in of the cable. The openings are slightly over 3 inches in diameter and beveled at the ends; the cross-section for any number of duct is rectilinear, with curved corners; the partition walls are uniformly five-eighths inch thick, and the outer walls three-fourths inch thick; the two-duct and four-duct sections are 8½ inches wide, and the three-duct and six-duct sections 13 inches wide.

The McRoy conduit was adopted because it seemed to embody the following meritorious features: the glazed clay surface makes it both impervious to moisture and indestructible except through mechanical means; this surface also offers the least friction when drawing in cable, the interior being very smooth; the multiple duct feature means a saving in excavation and repaving as it directly affects the width of the trench, and, being made in lengths of 6 feet each, means a saving in the number of joints, and a more perfect alignment. This is somewhat offset by the awkwardness of handling long lengths and their weight, and the inability to make smooth curves, though this latter point hardly figures in the installation, as the trenches are uniformly straight.

In laying the tile the trench is opened far enough in advance to insure a straight pathway with no obstruction, and carefully graded to the desired depth, when a concrete bed, 3 to 6 inches thick, is put in, consisting of one part American Portland cement, three parts sand and six parts crushed stone. Upon this bed the conduit is placed in such combinations as to give the number of ducts required, 3 inches of concrete being placed on the sides and tamped down with each layer, and a 3 to 4-inch covering of concrete forming the top.

With a view to strengthening the joints, and also to help in aligning, the ends of this tile are made with dowel-pin openings to take a steel pin of about one-half inch diameter, 6 inches being the usual length employed in this construction. This dowel hole runs the entire length of the tile, so that a pin can be inserted even in the short pieces cut to special length where the conduit enters a manhole. After the pin is inserted the joint is wrapped with a piece of wet burlap to insure the proper adhesion, and then plastered with a coating of cement mortar; this burlap strip being long enough and wide enough to properly cover the joint.

In the construction of manholes a vitrified paving brick is used, all the walls being at least 13 inches thick. These manholes are made 3½ × 3½ feet, 4 × 4 feet, and 5 × 5 feet, have a 6-foot head room, and are built upon a concrete bottom 12 inches thick. The smaller size has a corbeling top upon which rests an iron cover frame weighing about 900 pounds. The manhole cover is a steel casting and weighs about 400 pounds, is circular in shape and 36 inches in diameter. The larger vaults have walls 18 inches thick half way up and 13 inches the rest of the way, the roof being composed of concrete and 6 × 2 inch I-beams, upon which the frame and cover rest. This cover rests upon a rim which is made to take treated hemp packing, excluding all chance of water entering the vault by this means, all the covers being solid. Ventilation is effected through an iron pipe leading from the vault near its roof to the curb, where it projects up about three feet and has a goose-neck top to prevent the entrance of extraneous matter. Any water entering the vaults through the ducts can be readily pumped out of a sump, which is formed in the centre of the bottom for this purpose, no sewer connections whatever being made.

Between 550,000 and 600,000 duct feet of this tile will be installed, the greater part of which is now in. With 300 men and a trench in which eight ducts are to be laid, about three blocks a day can be completely installed, 5000 duct feet being a low daily average. As much as 12,088 duct feet have been put underground in one day. In all, this work will comprise aboout 20 miles of trench and 275 manholes, and will cost about $230,000.

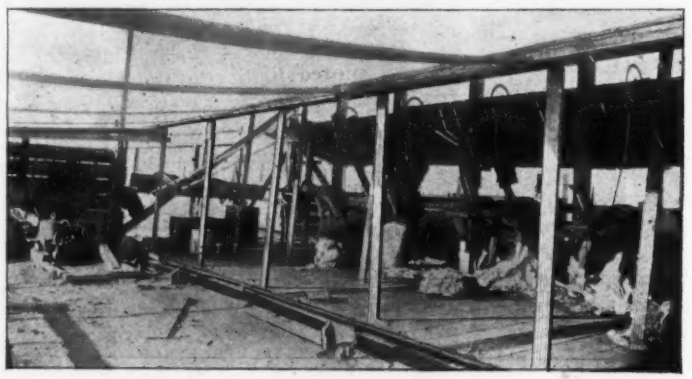
Sheep Shearing by the Aid of Electricity.

BY W. D. DICKINSON.

Great Falls, Mont., has for some time been credited with being in advance of other places in the numerous uses to which electricity is applied, and now it again comes to the front with a claim that it is the only place on earth where sheep shearing is done with the aid of electricity.

Many attempts have been made to construct a sheep-shearing machine for use here which would do the work formerly done by hand, but none proved successful until the Woolsey shearing machines, brought from Birmingham, England, were put into operation this spring. These machines have proved their merit, and five or six sets have been in use in different parts of the United States. One set of twenty was installed at Great Falls, Mon., which has become by far the largest wool shipping point of the Northwest.

Shearing sheds were erected at Black Eagle Dam, near the terminus of the street railway company's line, and this company furnishes the power to drive the shearing machines. The amount required was only 6 horse-power, and there being at the time no shunt-wound motor available, a street railway motor, type W P. 30, was taken from one of the cars, the armature pinion being replaced by a small pulley which was belted to the main overhead shaft. Because of the small amount of power used, two rheostats were required to keep the speed low enough.



Sheep Shearing by Electricity.

After the machines were started no difficulty was experienced in keping the speed uniform, as there were twenty of them constantly at work. The foreman of the shearers, after five minutes' instruction, took full charge of the motor, giving it all the attention necessary, in oiling, starting and stopping. The machines were operated for nearly three weeks by this motor, and in that time sheared 16,184 sheep, averaging nearly 100 sheep per day per machine.

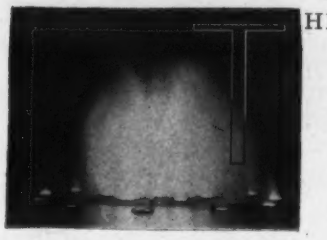
The shearing proved quite an attraction, the street railway company carrying a large number of passengers to witness the novel sight.

The accompanying illustration shows a corner of the sheds. The street railway motor, seen on the right, rests on a stone base, and is belted to the overhead shafting which drives the shearing machines. The shears resemble horse clippers in their operation, the power being transmitted to the same through universal joints.

A Magnetic Freak.

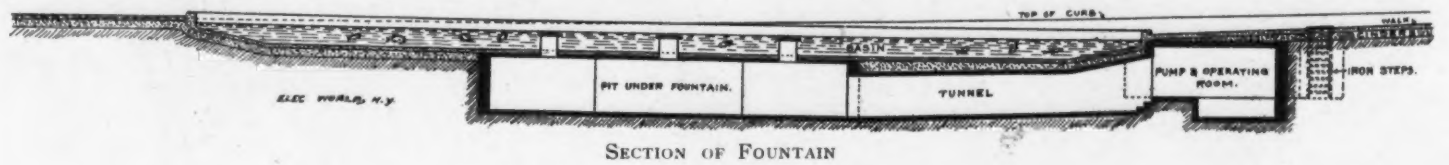
A writer to an English contemporary claims to have found that table knives, of which he tested several hundred, are invariably magnetic, and always have the north pole at the rounded end of the blade.

The Electric Fountain at the Prospect Park Plaza, Brooklyn.



THE electric light, aside from its utilization as an illuminant, stands pre-eminent in the production of beautiful and artistic effects which would be practically impossible with any other agent. In the decoration of interiors, sign effects, portable light effects, stage lighting, etc., both arc and incandescent lights find a ready field. One of the more recent applications of the electric light to such purposes, the electric fountain, furnishes a most prominent example of its possibilities in this direction. Although simplicity itself in construction and operation, the effects obtained even on a small scale are most gorgeous, and arouse a thoroughly appreciative sentiment in the layman, who not been neglected. The use of several vari-colored incandescent lamps of high candle-power under each glass funnel, any one of which may be illuminated or extinguished, has also found successful application in miniature fountains.

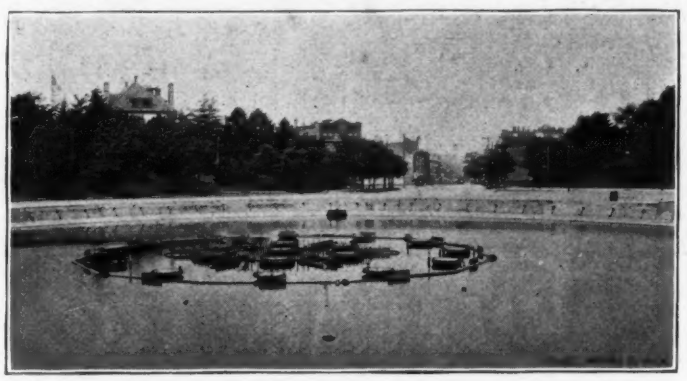
As a public attraction the electric fountain has been found to be *par excellence*. Electric railway companies, department stores, and other enterprises desirous of attracting and interesting the public have found this a most excellent means. With this point in view several such fountains have already been installed, among which the one just completed at the Prospect Park Plaza, Brooklyn, generally known as "The Circle," and on the lines of the Brooklyn Heights and Nassau Railway companies' systems, is probably the finest example. Previous to the construction of this fountain there was located on this spot an ordinary cascade fountain of the antiquated, non-luminous day display type. The Brooklyn Park Board decided that something more up to date and beautiful would add to the attractiveness of this locality and be more



SECTION OF FOUNTAIN

regards the red, green, blue and other vari-colored "electricity," emanating apparently from the ground, with admiration and wonder.

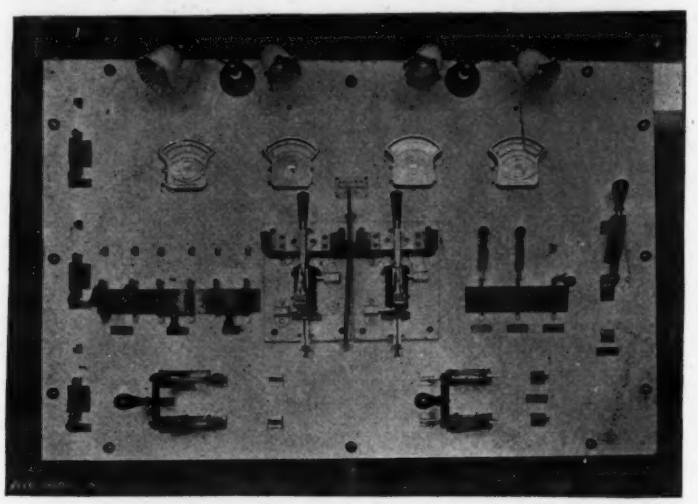
To effectively combine a colored beam of light with an upwardly or otherwise directed stream or spray of water so that it apparently partakes of the colored luminosity, and appears as streams of brilliantly colored light whose hues are changed at will, is easily arranged. A careful disposition of lights and sprays is essential, but the actual apparatus necessary consists simply of a properly directed stream or spray upon which is projected, or which is surrounded by, a beam of suitably colored light emanating from a glass-covered aperture, through which or around which the water outlets are arranged. The beam of light is projected from beneath the funnel, and passes through a variety of differently colored glass screens which impart to the projected beam the desired hue. In some of the earlier electric fountains, and even at the present time for illuminating horizontally directed streams, the beam from the



THE FOUNTAIN BY DAY.

source of light is directed horizontally, being thrown upon angularly placed reflectors beneath the glass-covered aperture, whence it is directed through the color screens intervening between the reflector and the window. In some of these fountains the color screens or discs are mechanically operated at each individual illuminating aperture, while in some others they are connected to suitable mechanical devices terminating in a group of handles placed in the vicinity of a corresponding group of valves controlling the water outlets.

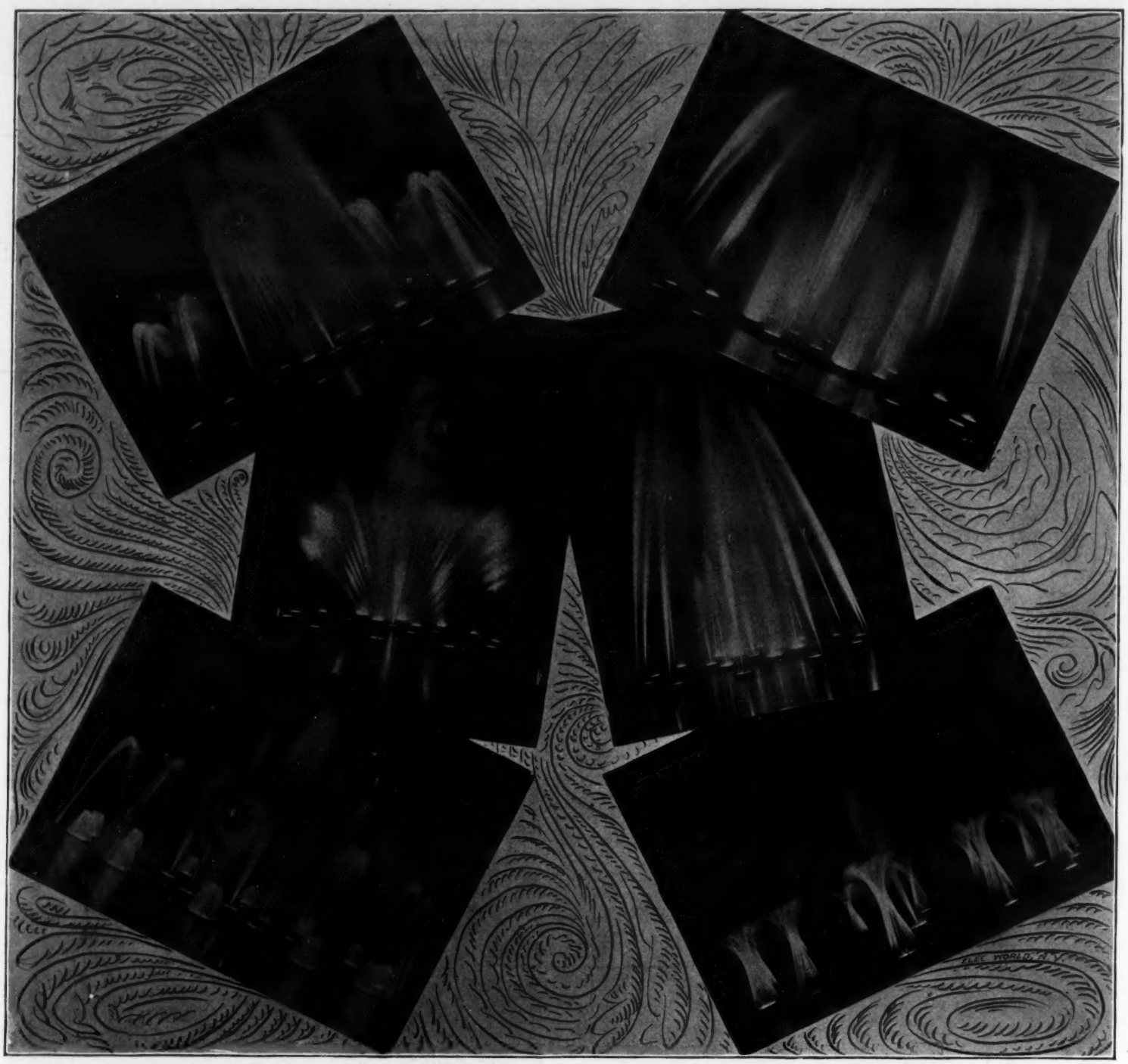
A varying number of light apertures, or funnels as they are called, may be used, and through the centre or around these are arranged the various water jets, sprays, streams, etc. In some instances the color-operating handles have been separated from the water-operating handles, necessitating a signal system between the two of some kind. In the present electric fountains the arc lamps are arranged immediately beneath the glass funnel so that the light beam is thrown directly upward. The incandescent lamp has also in keeping with the surroundings. The two trolley companies entered into hearty co-operation with this plan, fully appreciating the advantages resulting to their respective roads, and agreed to maintain the electrical machinery and operate the fountain for three years free of all cost to the city, the latter only caring for the hydraulic portion and supplying the water. The Wilson & Baillie Manufacturing Company was contracted with by the Park Board for the construction of the fountain, which was designed complete in all its details by Mr. F. W. Darlington, who has already devised several large electric fountains, but has embodied in this various new features and made it as a whole the largest and most complete of its kind. The contract price without the isolated pumping outfit,



THE MAIN SWITCHBOARD. .

to be installed later, was nearly $25,000. When the latter is installed the entire cost of the fountain will reach nearly $33,000.

Located immediately in front of the Soldiers' and Sailors' Memorial Arch in the centre of a large oval grass plot, the fountain occupies a most prominent position, being easily seen from any of the various car lines which almost encircle it. The circular basin has a concrete foundation and a cement bottom and side coping running around its entire circumference. The bottom of the basin is inclined toward the centre, and has a diameter of about 120 feet. The actual diameter of the fountain proper, that is, the jets and illuminating funnels, which are arranged circularly, is about 40 feet. Around the inner edge of the cement coping are arranged at regular intervals about eighty-eight 25-cp incandescent lamps, each enclosed in a waterproof globe. These lamps are wired alternately in brass-armored conduit tubes laid in the cement coping around the basin. They are used for illumination at night when no display is being made.



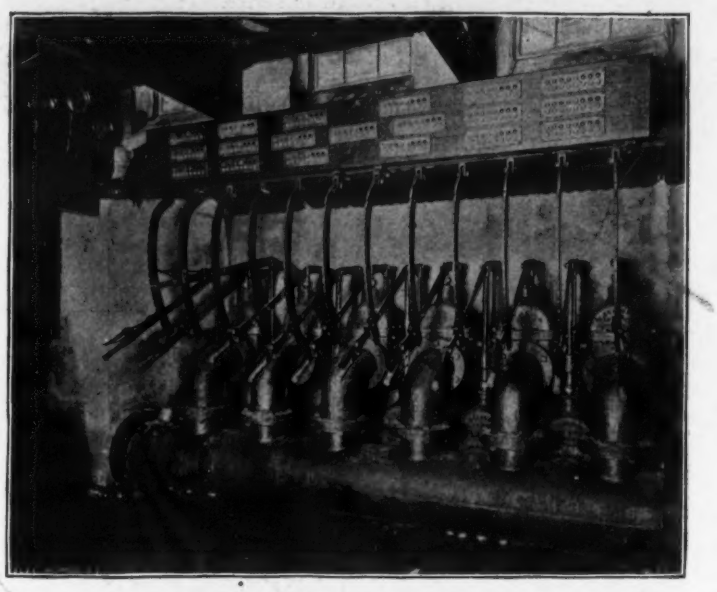
Some Views of the Fountain in Operation.

Immediately beneath the entire basin is a large room, in which are placed the lamps and color screen apparatus. Running from this lamp room is a short tunnel extending to the operating room, in which at the present time the main current supply switchboard and the water-operating valves and the color-screen controlling buttons are located. In this room provision is also made for a large electric pump, which will probably be installed before long. The height of the lamp room is about 8 feet, and the operating room is connected with the ground level by a short stairway. The entire interior construction for supporting the basin is of very heavy steel pillars and beams, with corrugated steel arches between beams, it being particularly intended that the fountain should be a permanent feature, and great care was therefore exercised in this direction. Incandescent lamps are used for illuminating both the lamp and operating rooms, and a large electric motor ventilator has also been installed.

When operating under average conditions the fountain requires about 100,000 gallons of water per hour. At the present time the water supply is taken from the city service. A main from the ordinary supply system is brought to the operating room, from which water may be taken at 30 pounds pressure, or it may be taken from another main extending from the high-pressure tower located in the vicinity of the fountain, which supplies water at about 45 to 60 pounds pressure. These two water supply mains make a suitably valved Y connection with the main fountain supply pipe. The pump when installed will also be connected at this point. An important arrangement of this piping system consists of a large air head placed near the junction of the various supply pipes. This hsa been found to be a very essential feature, as a great deal of trouble has been experienced in some previous fountains owing to the shutting off of the water supply at the controlling valves. With the present water supply the streams from the high-pressure service reach a height of about 40 feet, with the minimum outlet, this height being slightly decreased in the combination effects.

The water-supply main into which the various supply pipes feed is placed on the fountain side of the operating room immediately below several small windows, through which the operator may look and see the fountain in operation. These windows are an important element in the entire construction, as by this arrangement the use of the indicating appliances has been found entirely unnecessary, the operator, while controlling his valves and buttons, having the resulting effect directly in view. There are twelve combinations

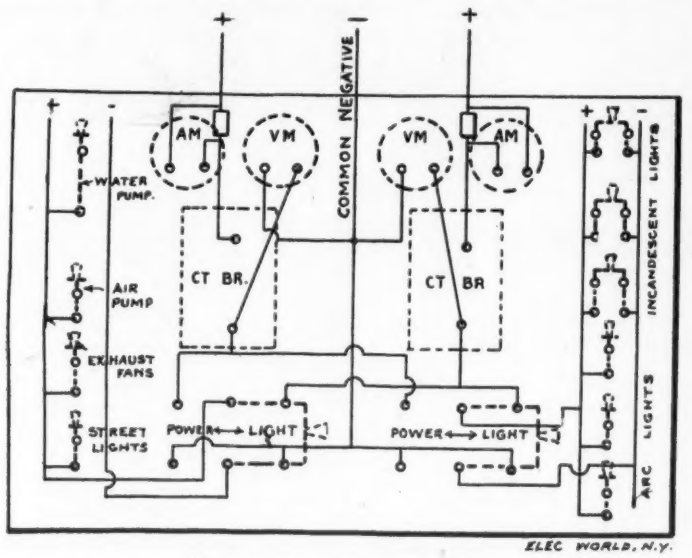
of water, spray, jet, and other effects, varying from one to several hundred outlets, and to supply these twelve combinations twelve separate taps are taken from the main pipe extending upward to a corresponding number of gate-lever controlled valves, from which these supply pipes extend up to the bottom of the fountain and pass



OPERATING VALVES AND BUTTONS.

to the various outlets. It will be seen from the illustration that the combination effects are supplied by pipe circles, each of which is suitably connected to one of the twelve pipes above mentioned. The very best grade of wrought-iron pipe has been used.

There are nineteen light-producing funnels, arranged in two concentric circles around one single central funnel. These light funnels or apertures project somewhat above the bottom of the fountain, and are covered on top with heavy plate-glass windows. They are circular in cross section and about 2 feet in diameter, with the axis of the cylindrical aperture at almost right angles to the plane of the fountain base. Twelve of these funnels are arranged equidistant around the outer circle. The sprays and jets are placed about these funnels in various combinations. Immediately below each funnel aperture, in the room beneath the basin, is a Colt focusing-projection lamp of high candle power, taking about 40 amperes at 50 volts. There are nineteen of these projection lamps,

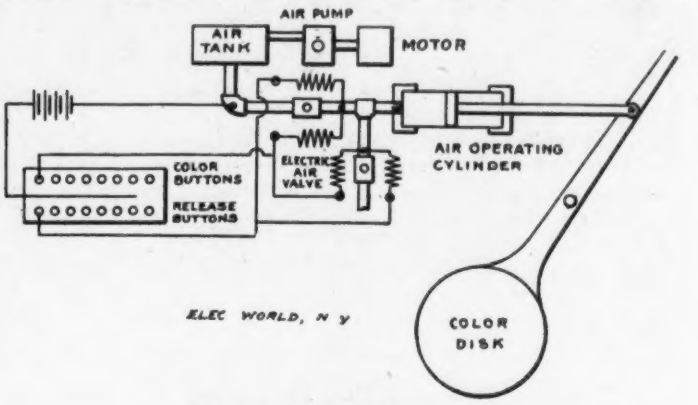


SWITCHBOARD CONNECTIONS.

which correspond to the nineteen light funnels. The carbons of these lamps are cored. The feed mechanism consists of a strong barrel spring suitably geared to the carbon rods, which is wound whenever the lamp is trimmed. The arrangement of the reflector and mechanism will be readily seen from the illustration. The entire lamp mechanism is supported upon an iron upright mounted upon a heavy base, and fitted on top with an adjustable clamp, permitting the lamp to be moved through an arc of some size. Each lamp is placed upon a wooden platform, which is separated from the floor by porcelain insulators.

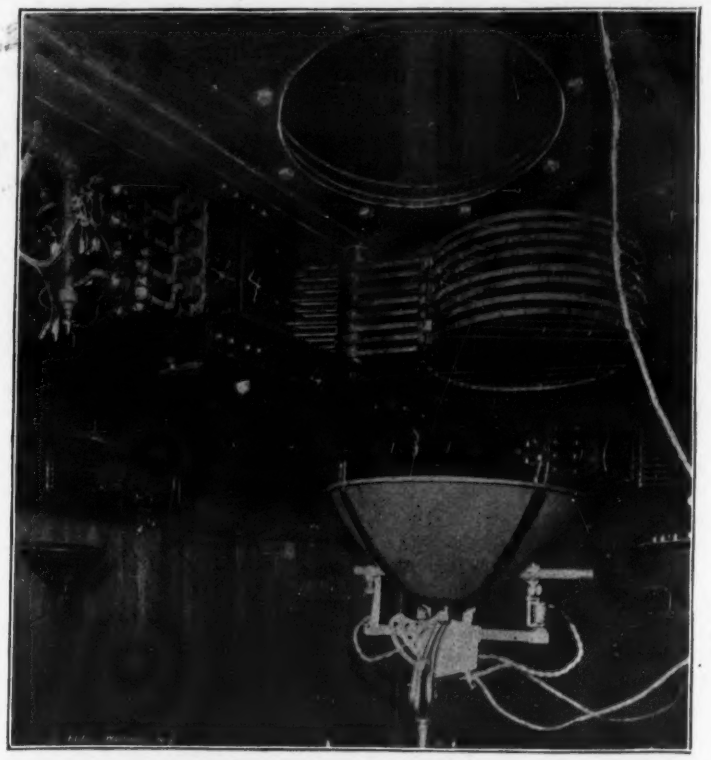
The color discs are aranged in a somewhat novel fashion. Each funnel has a set of eight color discs, each of which is fitted to the end of a pivoted arm, and all the arms of each set are pivoted on the same axis on ball bearings. When not in use these discs are just off the funnel opening. The other end of the pivoted arm is connected with an electro-pneumatic operating mechanism, whereby any one of the discs is moved so that it is interposed between the opening and the lamp.

Altogether there are probably 2000 water outlets, varying in size from 1½ to ⅛-inch opening. Several new effects are embodied in



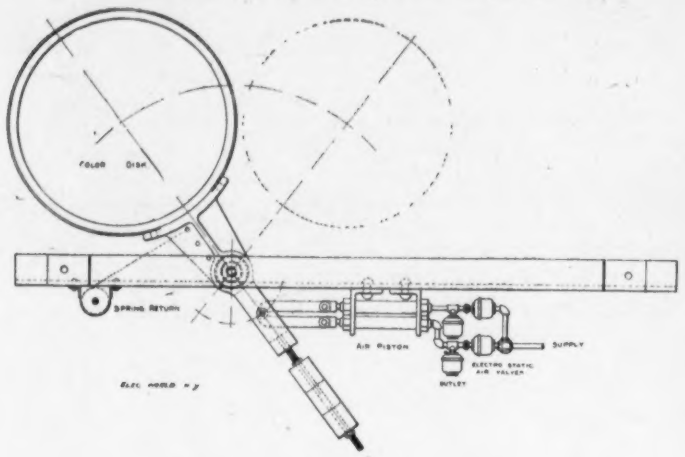
SCHEME OF DISK OPERATION.

the arrangement of these outlets. These effects may be used either individually or in combination, each being controlled by its individual valve at the control room. The central figure consists of a single large stream or geyser, emanating from a nozzle in the centre of the central light funnel. The second consists of a circle of twelve fancy streams, including ball nozzles, umbrella sprays, whirligigs, etc., one on the outside of each of the twelve light funnels, forming the outer ring. The third figure consists of a circle of small jets around the central light funnel. The fourth figure is a combination of small jets arranged around each of the light funnels of the inner circle, and a circle of small jets concentrically arranged around the inner light funnel immediately inside of the inner circle of light funnels. These two effects are so arranged that they can be used together or separately. Figure 5 consists of



DETAILS OF COLOR DISKS AND LAMPS.

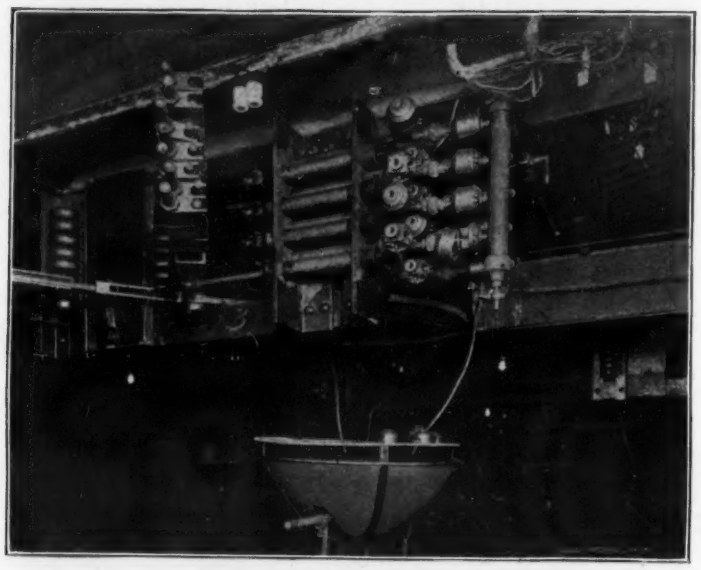
two parallel rows of small jets arranged on each side of the central funnel, the spray from which forms a fan effect. Fig. 6 consists of a circle of jets arranged around the outer edge of each of the outer ring of funnels. Seven is a wheat-sheave effect composed of circles of small intersecting sprays around each one of the outer funnels. Single streams in the centre of each of the inner circle of funnels form Figure 8. Another ring of sprays around each of the inner circle of funnels is the ninth combination. Ten consists of short strips of up and inwardly directed sprays, outside of each funnel in the outer



Details of Disk Mechanism.

ring. Eleven consists of six short radial spray lines between the inner circle of funnels. A circle of sprays surrounding these funnels makes the twelfth display.

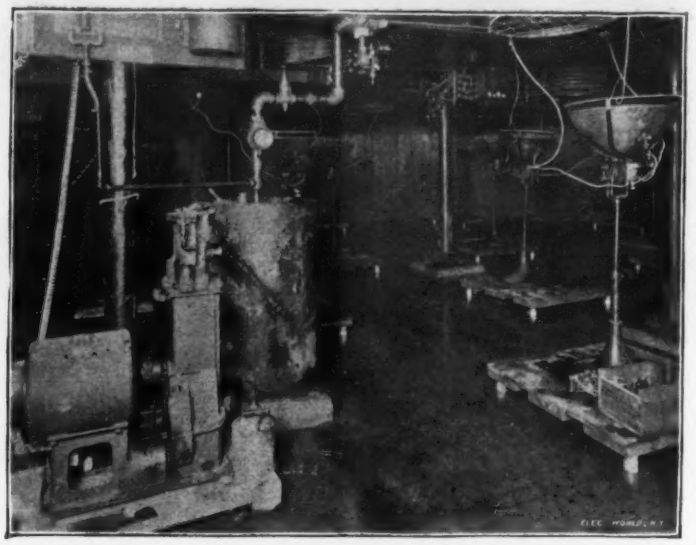
The proper combination of these figures, when either used singly or together, gives a most artistic effect, even when the color beams are not in operation. It is, therefore, entirely feasible to work the fountain during the day as well as in the evening, or without light projection from the funnels.



Details of Electro-Pneumatic Color Disk Mechanism.

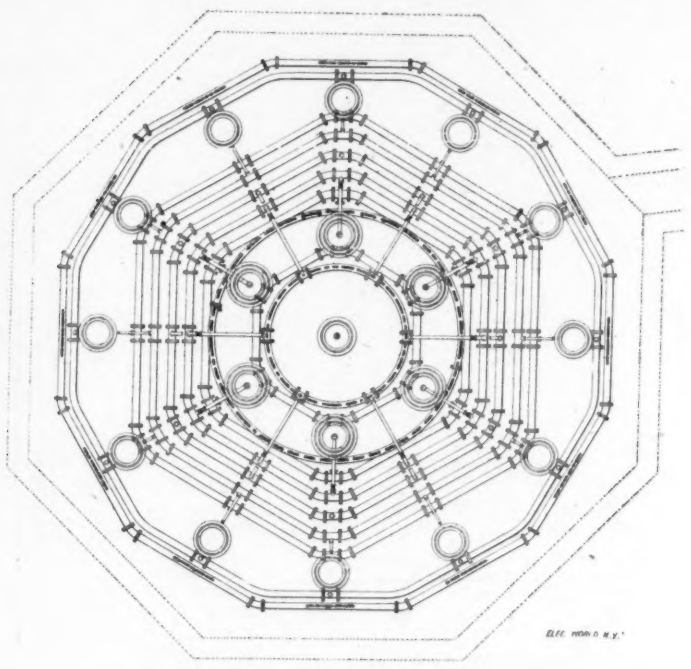
As has already been stated, the current is to be supplied by the two railroad companies above mentioned. For this purpose a separate supply main from each system is taken from the adjacent feeder systems, being carried from the pole lines down to an underground duct and thence to the operating room. A common return wire to the rails is used for both systems. These conductors are brought to the supply switchboard, which is located immediately alongside of the operating valves and controlling buttons. It consists of a marble slab, equipped with suitable meters and quick-acting single and double-pole switches, which are so arranged that the current can be taken from either system, but making it impossible to throw both supply systems together. One side of the board is used for power supply and the other for lighting. The arc lamps are run in three circuits from one side of this board, two of these circuits having six lamps in series and one having seven. Each of these circuits is controlled by a single-pole switch, and has an adjustable resistance located in the lamp room. All the wire used throughout has high-grade rubber insulation, and is run on porcelain insulators. A common return wire is used for each of the three-arc lamp circuits, and also for the incandescent circuits, the incandescent lamps being also wired in series.

The operating mechanism for the color discs is particularly novel and interesting. There being 152 discs, eight at each of the nine-



Air Compressor and Arc Lamp Beneath the Fountain.

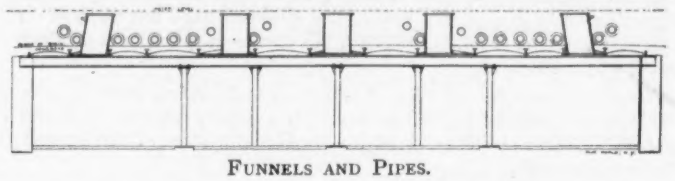
teen light funnels, it became quite a problem to suitably concentrate the operating mechanism for these various color screens, as it was intended that both the water and color discs should be controlled from one point. An electro-pneumatic system of operation was adopted for this purpose, consisting of a small air-pressure cylin-



Plan of Funnels and Piping.

der in which moves a piston suitably connected by link rods to the free end of each of the pivoted color disc levers. These cylinders and also the suitable valve mechanism, are supported upon the same frame with each set of pivoted-disc levers. The air supply for these pneumatic pistons is furnished by a Hunt electric air compressor automatically controlled, which is located in the lamp room and feeds into a reservoir. The air compressor works at 70 pounds in feeding to the reservoir, but the supply pipe from the reservoir is taken through a reducing valve, reducing the pressure to about 10 pounds. This pipe extends to each of the various operating sets, and a small tap is taken to each of the air cylinders, the inlet

being controlled by an electric valve. Between this valve and the operating cylinder is another similar valve, tapped to the supply pipe and used as an air outlet, When either of these valves are opened the other is closed, owing to the inter-connection of the operating magnet. Their arrangement will be readily understood from the illustration. They are, in fact, ordinary automatic gas burner valves, with double magnets, one for opening and the other for closing the valve. The method of wiring is also shown, and it will be seen that this is so arranged that the operation of any button to operate the inlet valve and thereby move the color screen into active position, at the same time closes the outlet valve, and this operation is reversed whenever the outlet valve is operated to exhaust the air cylinder and allow the color disc to return to its



FUNNELS AND PIPES.

normal position. A separate cable composed of sixteen number 14 B. & S. wires runs from each set of valves to a set of buttons placed on the color board over the hydraulic operating valves in the operating room. A common return is used for all the magnets. Each of these compound buttons consists of sixteen separate pushes in two rows, each button of the top row being colored and corresponding with its respective color disc which is operated when the button is pushed. The lower row of buttons are all white, and act as release buttons for each of the upper buttons below which they are located. An ordinary set of open-circuit batteries are used to operate these electro-pneumatic valves. When the release button is pushed, allowing the disc-operating cylinder to be exhausted, the disc is automatically returned to its normal position by means of a barrel spring, which is shown at the right in the illustration. The fact that each of the color discs carrying levers is mounted on ball bearings greatly facilitates their operation. The concentration of the entire operating mechanism at one point has made it possible to suitably work the fountain with only two men, one being located on a platform in front of the valves and color buttons, and the other having charge of the lamps beneath the basin. The man at the controlling appliances simply raises his levers to effect any suitable water display, after having pushed the necessary color buttons for the different funnels. This concentration greatly facilitates the operation of such fountains and expedites the shifting and changing of the various figures, producing results of great artistic beauty and most wonderful combinations of color which can be shifted with amazing rapidity. This fountain will unquestionably long remain a centre of attraction, and owing to the accessibility of the various spouts, and the fact that large additional basin surface is available, the water figures and combinations can be changed at intervals, always producing new and novel effects.

Fire Switches.

BY JAMES F. HOBART.

The promiscuous wiring of a repair shop or car barn should never be permitted. Some good system should be devised and then rigidly adhered to, otherwise there will be loss of life or property when accident occurs. Take, for instance, the exposed wiring in and around the car barn. In case of fire, current must be cut off, or the lives of firemen and others will be put in peril needlessly.

Do not start such wiring from the switchboard of the generating plant, if such plant is located in the building. Instead, or if so located, run the wiring out of the building as straight as possible, and in some isolated place, say on a pole on the opposite side of the street, put a fire switch, which is to be used for no other purpose than for cutting out the shop or barn wiring in case of fire. Acquaint the fire department with this switch, its location and purpose, and see that they understand its use.

Inside the building, at the main entrance, run the leads from the switch or cut-out just noted, and there locate another and similar cut-out for use by the company's men in case of necessity. Let it be the business of two trusty men to at once proceed to these switches in case of fire, and to stay there until recalled, for it is rather aggravating to have current cut off by some unauthorized officious person before there is actually any need of it and before cars that might be saved have been run out of the building.

Fire or section cut-outs are, of course, located as required at various points on the line so as to afford protection for firemen wherever a blaze may break out, but the exposed wiring in a barn or shop needs special protection as noted. The insulated feeders do not matter as much, for if necessary to cut off the current from them it should be done by telephonic instruction at the power house. In the case of broken shop wires, the arrangement noted above may save life, and it is sure to save property.

Prof. Dolbear's Experience with a Ghost.

It is very rarely indeed that a matter-of-fact professor of scientific truths becomes susceptible to the influence of that evanescent intangible thing commonly called a ghost, but Professor Dolbear, of Tufts College, can now tell a ghost story from personal experience with one of those unearthly visitants. Not only did he see one, "with his own eyes," as the dime novelists would say, but he actually conversed with it, so we are informed by a dispatch from Boston a few days ago, which contained the information thus summarized. The story has reached the knowledge of the Society for Psychical Research, therefore it is reasonable to suppose that the learned professor will be catechised and investigated by the society in order to get at the real basis of the occurrence. The fact that a college professor has seen and talked with a ghost will no doubt tend to stimulate the belief that ghosts are realities after all. According to the story, Professor Dolbear had just returned from Eliot, Me., where he attended the recent meeting of the American Institute of Electrical Engineers, at the home of the late Professor Farmer. Professor Dolbear, it appears, one night during his visit at Eliot, slept in a room known locally as "the room of the seven doors." This particular room is a small apartment, nearly square, and is light, airy and comfortable. The collection of doors, of which there are seven all just alike, is its most notable feature. They are finished in the natural wood, and each has a white china knob. Professor Dolbear had spent the previous evening, so the story goes, talking with Miss Sarah J. Farmer, daughter of the deceased electrician, and when he retired he was thinking of the professor. What followed is best told in his own language. He says: "How long I lay there before sleeping, or whether I went to sleep at all, I do not know, but presently I was conscious of some presence in the room. A moment later I saw Farmer standing by the bed. At least, I recognized the figure as that of Farmer, and I was surprised, but I do not recall that I was very much startled. 'Hello,' he said, or something of that sort; a salutation, at all events. I replied in kind and said: 'Who are you?' 'I am Farmer,' was the answer, and he held out his hand to me.

"I shook hands with him, and I thought as I did so that the fingers felt a little cold. I released the hand, and was thinking about the matter, when considering what next to say. When I looked up he was gone. If I was awake at the time I fell asleep again, at any rate, I let the matter pass, though somewhat puzzled; but very soon the figure was again standing by the bed.

"I do not know," continued Professor Dolbear, "that I doubted it was Farmer, but I thought I would make certain, so I said: 'How shall I know you are Farmer?'

"'I will show you my hand,' he said. In the dark I saw that he was holding out his hand that I might see it. But I was determined to take nothing for granted, so I said: 'But how shall I know it is Farmer's hand?'

"'I'll show you my finger,' he replied, and then he crooked up one of the fingers in such a peculiar way that I tried to imitate him. I could not do it without the assistance of the other hand, and while I was trying to perform the little trick the figure disappeared. I puzzled over the vision, or dream, or what you choose, for some time, but then I once more went to sleep—if I had been awake—and I saw nothing more of the figure. In the morning I told Miss Farmer of my experience, to her very great interest. When I came to the trick of the fingers she looked at me astonished.

"'That,' she said, when illustrated as best I could, 'was a favorite little trick of my father; few people could do it.'

"It appears," Professor Dolbear concluded, "that whenever Farmer met a person to whom he took a liking, when the acquaintance came to an informal footing, it was his way to hold out his hand, crooking his finger in the way I have shown you, and to say: 'Can you do that?' It was a little thing, perhaps, but peculiar to the man. We all have minor characteristics by which we may be known."

DIGEST OF CURRENT TECHNICAL ELECTRICAL ARTICLES COMPILED FROM FOREIGN AND AMERICAN JOURNALS

BY

CARL HERING

DYNAMOS, MOTORS AND TRANSFORMERS.

Armatures with and Without Teeth. V. DOLIVO.—DOBROWOLSKY. *Elec. Zeit*, July 29, translated in full in the Lond. *Elec. Eng.*, August 6.—A reprint of a short paper read at the meeting of the Union of German Electricians. He offers a simple explanation of several points which are still being discussed. Mordey recently again raised the question of whether a mechanical force acts on the copper wires which are embedded in the iron of the armature; the present writer claims that Mordey made no mistake in his test, but that he did not offer a proof of his assumption; to supply this the present writer states that if a single loop be passed through two of the holes at the periphery of an armature so that it can be easily moved through a short distance, it will be seen that by such a movement the number of lines of force enclosed by the loop, when both the armature and the field are at rest, will not be changed, as all the magnetism will pass through the iron and not through the holes; from this it follows that no E. M. F. will be induced by such a movement and no work will be absorbed, therefore such a coil, when the current passes through it, will not tend to move in any direction; when no work is done by such a movement it follows that there will be no mechanical force exerted on the wire by induction of the current in it; the whole of the force is therefore taken up by the iron; this is important for constructors, as they need protect the wires only against the action of centrifugal force. With smooth armature cores the case is quite different, the force acting directly on the copper wires. Another disputed question concerns the Foucault currents in large conductors; on smooth armatures such Foucault currents are produced, but when the conductors are embedded in the iron, always assuming unsaturated teeth, the magnetism may be said to jump from one tooth to the next, so that the field in the hole may be said to be uniform, and therefore in such armatures no Foucault currents are produced in large conductors. He adds that lines of force should be assumed to represent only the direction and quantity of the magnetic field, and should not be considered as real threads.

Running Three-Phase Motors from Single-Phase Circuits.—Elek. Anz., July 29.—An illustrated description of the system patented by the Union Company. The junctions of the three circuits of the inducing winding are connected separately to the two outside wires from the secondaries of two transformers in series, and the third to the connection between these transformers; the primary windings of the transformers are connected in series to the single-phase wires; after the motor is started the single phase E. M. Fs. will be split up, so that the motor runs nearly like a three-phase motor. The connections are shown by a diagram including one for a railway motor.

Construction of Armature Cores.—BAXTER. *Amer. Mach.*, Aug. 12.—An article of a practical nature on the punching of the discs and the construction of the cores.

LIGHTS AND LIGHTING.

Arc-Light Suspension. RENTZSCH. *Elek. Zeit.*, July 22.—A reprint of a paper in which he describes a reel in the bottom of the poles, by means of which the arc light may be lowered; the suspension wires form the conductors.

Lamp Sockets. GRUENWALD. *Elek. Anz.*, Aug. 1.—Numerous illustrated descriptions of the later forms of some key and keyless sockets.

Condensers in Alternating Arcs. CLAUDE. Lond. *Elec.*, Aug. 6.—A translation of the paper which was noticed in the *Digest*, July 3 and 24.

Phosphorescent Lamp. PULUJ SYSTEM. *Sc. Amer.*, Aug. 7.—A brief and very inadequate description of his lamp. It appears that the cathode is a curved disc of aluminum, in front of which is a small sheet of mica, presumably at or near the focus, and painted with sulphide of calcium, an extremely phosphorescent substance; it glows with an intensely brilliant light; it is said that the lamp is not yet available for general lighting purposes but he is experimenting with it to make it so; he intends to produce "a chemical lighting system," that is, "the development of ethereal light vibrations by chemical means."

POWER.

Electricity vs. Shafting in the Machine Shop. BENJAMIN. Lond. *Elec. Rev.*, Aug. 6; reprinted from *Machinery* (N. Y.)—Tables and data giving a complete summary of his investigations; he shows that the first cost of electrical machinery is usually greater than that of shafting and belting, but that the saving in power in most establishments would pay for the additional cost in one to five years; the question does not depend on the efficiency, but on the effect which it has on the output of the product per man and per machine.

Electric Device for Moving Rudders.—Lond. *Elec.*, July 24.—An abstract, with illustrations, of the descriptive article referred to in the *Digest*, Feb. 20 (see also May 15), of the Essberger system, which is used on a German steamship.

Ventilating Fans. WALKER. Lond. *Engineering*, July 23.—The conclusion of the reprint of his long paper, an abstract of which was given some time ago.

Design and Construction of Electric Power Plants. ARNOLD. *West. Elec.*, Aug. 14.—The conclusion of the publication of 11 lectures delivered before the Engineering Society of the University of Nebraska, the beginning of which publication was noticed in the *Digest*, April 10. The lectures consist of a comprehensive review of modern practice in American electric power-station work by one actively engaged in the design of stations. The first lectures are devoted to a discussion of the various sources of power; the losses incidental to the transformation of fuel into electricity in the ordinary steam plant; the cost of production of power and the possibilities of economy at the different steps in the generation of electrical energy. Then follows a description of the various types of grates, furnaces, stokers, boilers, heaters, purifiers, pumps, condensers, engines and generators and other station accessories, with a statement of the advantages and disadvantages of each type, the conditions for economical operation, the efficiencies to be expected, and the things the designer of a plant ought to know in selecting the various classes of apparatus. The conditions which justify the use of condensers, economizers and direct driven pumps are pointed out. A very complete lecture is devoted to the question of piping, showing the connection of the various accessories, starting with a simple plant and finishing with a compound-condensing plant containing a complete equipment. Details of erection are given, showing several systems of drainage, and the provisions necessary to provide for expansion and vibration and prevent leakage and radiation. The method of the determination of the size of the stack and of the construction of typical brick and steel chimneys is given, and the advantages of forced draught are considered. One lecture describes the method of driving the generators and gives the details of plants using counter-shafting, belts, rope transmission, direct connection and the quill system designed by the author. The lecture upon storage-battery auxiliaries is of interest at this time, and is of special value, as it deals with the question of the comparative cost of a steam and battery plant, and points out the limitations which control the successful installation of a battery in the power house itself and also in sub-stations. A number of diagrams are given, showing the influence of a battery upon the load line of the station. The concluding lectures of the course are devoted to a discussion of the preliminary determinations, such as the selection of the transmission system, the location of the power house, the size of the units, and a description of ten modern power stations, which illustrate the various typical arrangements of building and machinery for belted, direct-connected, and composite plants.

Cranes on Board Steamers.—West. Elec., Aug. 14, *Elec. Rev.*, Aug. 11, and *Eng. News*, Aug. 12.—A illustrated description of those on the steamer "Bremen;" they have been so satisfactory that they are replacing the usual donkey steam engines on other steamers of that line. There are 16 in use on the "Bremen," 8 on each side of the vessel; the controllers are on the revolving platforms and are like those used on trolley cars.

Grain Elevators. DUNLAP. *West. Elec.*, Aug. 17.—An illustration accompanied by a short descriptive note of the one being erected in Buffalo, which will be operated by electric power from Niagara Falls.

TRACTION.

Specifications for Traction Motors in Belgium. L'Ind. Elec., July 25.—A reprint of the first part of the specifications for electric motors for the railroads of the Belgian Government. An editorial notice states that this Government began a series of tests in 1895 with a motor car which was run over all the various grades and at different speeds; the traction resistances for the various grades and speeds were determined, and from these the

specifications for motors to be used on the railroad lines were determined; the requirements for such motors were prepared with great care. A second series of tests was made on the line from Brussels to Tervueren with five cars containing motors made by the different prominent companies; as the cars were run on the tracks of a steam railway, accumulators were used as the source of current. The following is an abstract of that portion of the specification which may be of general interest: There will be two continuous-current motors on each car, and they are to be mounted on "intermediary" axles and are to drive without reduction gearing; the field winding is to be in shunt, but the magnetization is to be increased by a series winding, which is also to form part of the starting resistance; this is to be cut out of the circuit when the speed is at its maximum value; with 500 volts the two motors in series shall have a speed of 116 revolutions per minute, with a current of 150 amperes and only the shunt winding; the commercial efficiency in that case shall not be less than 75 per cent.; the gradual weakening of the field shall increase the speed to 173, the current and voltage remaining the same and minimum efficiency is then to be 80 per cent.; in parallel, with the maximum excitation by the shunt alone, and with 150 amperes, the motors shall have a speed of 231 and the minimum efficiency is to be 80 per cent; the same diminution in the field strength shall then increase the speed to 346 revolutions, the current and voltage remaining the same and the minimum efficiency being 82 per cent.; the armature winding shall be able to carry the normal current of 150 amperes, which can be raised to 250 during five minutes without dangerous heating, and the efficiency at the latter current shall not be reduced more than 5 per cent.; a variation of 10 per cent. is allowed for the speeds corresponding to the maximum shunt excitation; the maximum speed when the field is weakened in each of the groupings should be at least 1.5 times the speed at full excitation by the shunt alone in the same grouping; the motors should be identical, a difference of 3 per cent. in the speed being allowed when the armatures are connected in series and the shunts to the same circuits; at starting, the compound excitation being at a maximum, the torque of each motor shall be at least 300 kg at one meter from the axle; the internal resistances will be measured immediately after the current has passed for 20 minutes, except when 250 amperes are used, and it will then be measured five minutes after it has been increased from 150; the hysteresis, Foucault current, and friction losses will be measured together by the Houman method (not described). The rest of that portion which is published refers to details of the test, the controllers, wiring, etc.

Accumulator Traction on Steam Railroads.—Elek. Zeit., July 22.—A note stating that an accumulator car has been finished to run on one of the steam roads in Wurtemburg; it has four axles and two motors of 35 horsepower each; a trial trip was recently made; a trailer was attached and the speed was 22 km per hour, which is readily increased to 35 on the level; the total weight was 40,000 kg; it was also connected to three fully loaded freight cars of a total weight of 51,000 kg, which made the train weight 78,000 kg and the load was easily drawn.

Railways with Stationary Accumulators. SCHROEDER. Lond. *Elec* July 30.—An abstract of the paper, a long abstract of which was published in the *Digest*, Jan. 23; the illustrations, which form an important part of the paper, are reproduced.

Mechanical Features of Electric Traction. DAWSON. Lond. *Elec. Eng.*, Aug. 6.—The first part of a reprint of a long paper read before the Institution of Mechanical Engineers; in the first portion he gives some interesting statistics and summaries taken chiefly from American experience; among other things he states that the gross earnings of the street railways in the United States are approximately 50 per cent. of the passenger earnings of the steam railways, or 15 per cent. of their total earnings, whereas the mileage of the former is only about 6 per cent. of the latter; moreover the street railway receipts do not depend upon the prosperity of the country. He then discusses the mechanical features entering into the design and construction of an electric traction system, giving data and hints.

Automatic Switching of Traction Currents.—Zeit. fuer Elek., July 15.—A description of the Deri system for connecting and disconnecting the primary circuit of the transformers by an apparatus on the car, for use on his alternating-current system; an illustrated diagram is given.

Sliding Contact for Railways. POSCHENREIDER. *Zeit. fuer Elek.*, July 1, 15 and Aug. 1.—An illustrated reprint of a long lecture giving a historical summary of the various forms of sliding contacts for overhead and underground electric railways.

Electric Carriage.—Lond. *Elec. Rev.*, Aug. 6.—A brief illustrated description of what is said to be a very successful one in Brussels. It has 48 cells of accumulators, each weighing 9 kg, the plates being of the Planté form; their capacity at 18 amperes or 1.5 amperes per pound, is 6 ampere hours per pound; they are charged in from 3 to 3.5 hours; the plates are separated by celluloid; the single motor weighs 125 kgr; the carriage is a 4-wheeled dog cart for 4 persons and weighs with battery and motor 1100 kgs.; it will run 40 to 50 miles at 10 miles an hour without recharging; it is thought that the life of the cells will be not less than 2 years; it has solid rubber tires.

Horseless Brougham.—Sc. Amer., Aug. 7.—An illustrated description of the Morris and Salom brougham, which is to be used in New York City. The motors and batteries are mounted on the front truck, the rear wheels being used for steering; two hp motors are used with 443 (?) cells of batteries (presumably meaning 44) and they have a capacity of 100-hp hours, making the total capacity about 12-hp hours, which is enough for 25 miles on ordinary streets, or 36 on asphalt pavements with small grades; the average speed is six miles an hour; the carriage is said to weigh very little more than the horseless hansom cab.

Conduit System.—Eng. News, Aug. 12.—A short editorial note on the system which was recently tested in Hamburg (presumably the Lachmann or some similar system, which has been referred to frequently in these columns). In the conduit is an inverted U-shaped trough which prevents the water from rising into the tube where the wire is placed. The track was 525 feet long, and there was a leakage of 0.2 to 0.3 ampere when the conduit was completely flooded; this increased to one ampere when the car was running over the track.

Monorail System.—Elec. Eng., Aug. 12.—A reproduction of some of the illustrations from the description in Lond. *Engineering*, noticed recently.

Electricity Replacing the Cable.—West. Elec., Aug. 14.—A note stating that the Chicago City Railroad Company had announced that its cable lines will soon be converted into trolley lines.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Prepayment Meters. COUZENS. Lond. *Lightning*, July 22, and *Elec.*, Aug. 6.—A reprint, with the illustrations and discussion, of the paper which was abstracted in the *Digest*, July 31. In an editorial notice in the latter journal it is suggested that such a meter need not be expensive, that extreme accuracy is not required and it would be a needless expense to make it an energy meter; no carefully adjusted shunt coil need be used to overcome the static friction; the range required is excessively small, as there would be little demand for such a meter for more than four or five lamps; it is thought that the regulated clock meter described in the paper gives the greatest hope in the direction of cheapness.

Electrochemical Rectifier of Alternating Currents. GRAETZ. *Zeit. f. Elektrochemie*, July 20.—A reprint of the paper which was abstracted in the *Digest* last week. In the discussion which followed Askenasy stated that Pollak, who used a similar system, has succeeded in making a cell with a counter E.M.F. of 110 volts, which was much higher than that of Graetz; it appears that the aluminum must be very pure and it is difficult to obtain it in this form. Liebenow described an experiment of Mengarini in which one pole of the alternating machine was connected to a large lead plate in sulphuric acid, while the other terminated in a thin platinum wire; the latter became red hot and from that time on a pulsating direct current passed through the circuit. Ostwald remarked that concentrated sulphuric acid and soap were examples of materials which allow the current to pass through them in only one direction. Correns suggested using two-phase or multiphase currents, in order that the continuous current does not pulsate so much.

Portable Lighting Plant.—Elek. Anz., July 29.—A brief illustrated description of a transportable plant on wheels, containing a petroleum engine, the chief feature of which is that it delivers power at every revolution instead of at every two, as most others.

Steamship "Dresden."—Lond. *Elec. Eng.*, Aug. 6.—A brief illustrated description of the electric plant.

Central-Station Statistics for Germany.—L'Ind. Elec., July 25.—An abstract, with a number of tables, from the article noticed in *Digest*, July 24. The Lond. *Elec.*, Aug. 6, also contains some abstracts from the original statistics.

Effect of Synchronous Motors on the Power Factor of Three-Phase Current Stations. KLASSON. *L'Ind. Elec.*, July 25.—An abstract, with the table, of the article which was noticed in the *Digest*, June 5 (see also July 17).

The Voltmeter in Series-Arc Stations. DOW. *Elec. Eng'ing*, Aug. 1.—A description of the various useful purposes to which the voltmeter can be used; it is very useful for adjusting arc lamps individually; for measuring the resistance of the shunt spools; for the measurement of the voltage of the entire circuits; for locating faults, a full description of the method being given; for testing circuits not running, in place of a galvanometer.

Test of a Government Plant.—West. Elec., Aug. 14.—A brief description of a test of a plant in the Hospital for the Insane at Washington, the output of which is 228 watts per pound of coal per hour.

Central-Station Troubles. LAKE. *Elec. Eng'ing*, Aug. 1.—A description of a simple device for finding open circuits; it is already well known by many station men and is applicable when both incandescent and arc-light machines are used at the same station. An incandescent lamp is connected through suitable fuses into the arc circuit; it will burn dimly when the lamps are fully trimmed and brighter when all the carbons are short. In another device (not new) a lot of incandescent lamps are connected in series and then in shunt to the arc light loop; the point on this shunt which can be grounded without affecting the brightness of the lamps, then corresponds to the same relative position of the fault on the arc loop.

WIRES, WIRING AND CONDUITS.

Rules for High-Tension Circuits.—Elek. Zeit., July 29.—A reprint in full of the rules recently adopted by the German Union of Electricians; they refer to plants in which the voltage is above 1000; an abstract is of very little use and is therefore not given; it concludes with a large number of simple (?) symbols to be used to represent the various parts of a plant.

ELECTRO-PHYSICS AND MAGNETISM.

Dielectric Constants. Drude. Lond. *Elec.*, August 6; abstracted from the *Wied. Ann.*, 7, p. 446.—He adapts his wire-wave method to measure dielectric constants of liquids, even when they are available only in very small quantities; the essential feature is the measurement of the capacity of a small condenser by the influence which it exerts on the phase of the electric waves reflected by it.

Galvanometer Method of Titration. Salomon. *Zeit. f. Elektrochemie*, July 20.—A reprint of a short paper read before the Electro-Chemical Society. He describes researches made at the suggestion of Nernst, which showed that the intensity of the residual current of a condenser which is obtained from the polarization of the electrodes, can be calculated exactly from the concentration of the ions of the metal of the electrode in the liquid, the coefficient of diffusion and the polarizing power.

Electric Pressure. Mebius. Lond. *Elec.*, Aug. 6; noticed briefly from the *Wied. Ann.*, 7, p. 638.—A mathematical article in which he derives the expression for the pressure by supposing a conducting sphere to go through the cyclical process of charging, heating, discharging and cooling.

Photo-electric Currents. Elster and Geitel. Lond. *Elec.*, Aug. 6; abstracted from the *Wied. Ann.*, 7, p. 445.—Descriptions of researches.

Electric Properties of Crystals. Beckenkamp. Lond. *Elec.*, Aug. 6; abstracted from the *Wied. Ann.*, 7, p. 597.—He examined the properties of aragonite and baryta.

Heat of Hysteresis. Weihe. Lond. *Elec.*, Aug. 6; abstracted from the *Wied. Ann.*, 7, p. 578.—He measures the relation between the area of the hysteresis curves and the heat actually developed in the iron, and used a new method; the magnetizing coil did not surround the samples direct, but was divided from them by a cylinder of ice; the results agree with those of Tanakadate and give 80 per cent. for iron and 75 per cent. for steel.

Diamagnetic and Feebly Magnetic Substances. Lombardi. Lond. *Elec.*, Aug. 6.—A long abstract from an Italian journal. After pointing out the great physical interest in the subject of diamagnetic substances, he describes his researches, which were intended to fill important gaps in the knowledge on this subject; he limited himself chiefly to solid bodies, but a few experiments made with solutions of salts of iron showed the absence of hysteresis and a constant susceptibility in varying fields. The results obtained for a large number of substances are given in tabulated form; they show the absence of hysteresis in diamagnetic bodies; the curve of magnetization, as a function of the magnetizing force, is a straight line passing through the origin for fields, varying from zero to several thousand units; if the force is cyclically varied between these limits, the curve does not appreciably turn out of its way; hysteresis was found in ebonite and indurated fibre, owing to traces of iron.

Induction in Short Soft-Iron Magnets. Eurich. Lond. *Elec. Rev.*, Aug. 6.—A short article consisting mainly of curves of results, without any general conclusions drawn from them. The object was to determine the induction and its distribution in short soft-iron electromagnets; the lengths were exact multiples of the diameters, which latter were the same in each case; the method of measurement is described.

Source of X-Rays and the Construction of Lenard Tubes. Tesla. *Elec. Rev.*, Aug. 11.—A very long communication discussing the source of the rays and giving illustrated descriptions of the construction and safe operation of improved forms of Lenard tubes; the latter part does not admit of being abstracted. Regarding the source of the rays he has been led to recognize that the chief source was the point of first impact of the stream of particles in the bulb; recent investigations have confirmed the correctness of this opinion; but this point is not the only source. He investigates the question whether the impact body must be within the tube; whether it must be a solid or a liquid, and to what extent the velocity of the stream is a necessary element; in connection with the first of these questions he endeavored to show that there is an actual penetration of the particles through the wall; he used an improved Lenard tube (the distinguishing feature of the Lenard tube, as well known to physicists, is that the cathode rays pass out of the tube through a small aluminum window, instead of through the glass); a silver coin placed near this window was made very hot while the window was only moderately warm; it was, therefore, acted upon almost as if it had been inside of the bulb; it behaved like a second source of the rays; he thinks there is not the least doubt that the cathode particles actually penetrated the window (the other two of the above questions do not seem to be discussed). In looking at a screen held at the side of the tube and parallel to the axis of the rays, curved and straight dark lines on an illuminated background were produced by the cathode, the window and other parts of the tubes; this showed that the fluorescent agency was proceeding from a place outside of the bulb toward the aluminum cap, and he explains this by assuming that the air and dust particles outside give rise to impacts and collisions spreading in all directions and producing new sources of rays; he thinks that if all impact particles are removed from the air it would behave as an impact body. He discusses the close relationship between Lenard and Röntgen rays; he believes that the Crookes phenomena are not dependent on high vacua, but that they could be produced at greater atmospheric pressures at much higher and more sudden electromotive impulses; a Lenard tube excited to a moderate degree gave no results until very sudden impulses were used, the total energy being no greater; the results increased until Röntgen rays of great intensity were produced, when the suddenness was sufficiently increased; he thinks that in lightning discharges Lenard and Röntgen rays must be generated at ordinary atmospheric pressure. Some data is given concerning the construction of his Lenard tube, the open end of which is closed by a sort of thimble of aluminum $\frac{1}{25}$ or $\frac{1}{10}$ in. thick; these are well adapted for the work of surgeons; the gap should be connected to ground, which diminishes the injurious action.

X-Rays in the Custom House.—Elec. Rev., Aug. 11, and *Sc. Amer.*, Aug. 7.—An illustrated description of the application at the custom house in France for detecting smuggling.

Rectifying Alternating Currents.—El'ty, Aug. 11.—A brief illustrated description of the Pollack system depending on the polarization of aluminum plates and described in the *Digest*, July 17. It is followed by a description of Perry's æolotropic device, which he described in that journal in 1891 and which he discovered three years previously; it consists of a hard rubber tube with a hole bored through it near the middle and perpendicular to the axis; a tight-fitting copper wire is inserted into one end and one of aluminum into the other, coming into mechanical but not electrical contact just below the perforation and their ends being faced with a film of black oxide of palladium; when connected to an electric circuit with a stream of hydrogen blown onto the contact, this contact will become conducting; after cooling a slight amount of hydrogen will make the junction highly æolotropic, conducting current easily in one direction but not in the other.

Elements of Complex Quantities and Vectors. Domerque. *Elec. Eng'ing*, Aug. 1.—A continuation of his long mathematical series describing their use in alternating-current work.

ELECTRO-CHEMISTRY AND BATTERIES.

Coal Gas Battery. Borchers. *Zeit. f. Elektrochemie*, July 20.—A fully illustrated and long paper, read at the meeting of the Electro-Chemical Society. He illustrates, describes, and discusses the inoperative battery which he brought out over a year ago, describing the difficulties encountered and admitting that it failed to comply with the condition that the electro-chemical reactions must be separated from each other; he stil. adheres to his original claim that the current from this battery was obtained by the oxidation of carbon monoxide and other carbon gases, and offers a proof of the correctness of this claim; quite a number of forms of apparatus, operative and inoperative, are described and illustrated; a number of unsuccessful experiments are described, one with gelatinized electrolytes and another with a mercury diaphragm. In conclusion, he gives the results of some tests of his final form, which he claims is a success; it appears that he uses peroxide of manganese for the means of ionizing the oxygen in the air, claiming that it is specially good for this purpose; the cuprous chloride is, as before, used as the solvent for the coal gas; for the anode portion of the cell he uses a mixture of peroxide of manganese in a basic solution of chloride of calcium; a diaphragm was necessary to separate the two compartments; an illustration of the apparatus is given; it consists of a low, flat iron retaining cell containing the manganese mixture into which air is forced through a tube; in this hangs a porous cup containing the cuprous chloride solution into which the gas is forced; the electrode in this compartment is carbon. The results of tests are given in a table; the cell contained 80 gr of the copper solution, 100 gr of sal ammoniac and 50 gr of sulphuric acid with 500 cu. cm of water; for 100 ohms external resistance the E.M.F. was 0.61 volt and the current 0.01 ampere; for 0.5 ohm external resistance, these values were 0.07 and 0.42 (it appears that the difference of potential and not the E.M.F was meant, although the latter is what is stated). Other tests were made with different liquids which did not dissolve as much of the carbon gas, but the E. M. F. was considerably lowered; he claims that none of the material of the electrodes takes part in the production of the current. He discusses the question of whether the result may have been produced by the process of neutralization between the calcium compound and the acid, as it is a necessary condition to have one of the compartments acid and the other alkaline; he shows by a table of results how small a portion of the reaction can be attributed to this. He then discusses the question as to whether the expected oxidation really takes place at one or the other of the electrodes and describes an experiment showing that H O ions were transferred from the manganese compound to the anode and were there converted into water and oxygen; he believes that it may be expected that powerful oxidation takes place in the porous cup, and that the easily oxidized gases act as a depolarizer and thereby increase the voltage of the cell. He admits that the researches were not completed, but states that the question is being examined carefully by Prof. Nernst; the cell in its present form is not suited for large powers, but he claims to have made a step toward the solution of the problem. In the long discussion which followed, Ostwald stated that the problem had already been solved by Grove and that it now

consists only in improvements; the important point is to increase the rapidity of the reaction, which is accomplished by heat when the gases are burned; this is partially accomplished by Borchers by the use of the peroxide of manganese. Coehn questions whether the carbon gas is really oxidized and whether the process would develop an E. M. F.; he thinks that Borchers has not proved that oxidation really takes place; such an oxidation does take place in Coehn's cell, in which carbonic-acid gas is produced; he questions whether the current is not due only to the reduction of the peroxide of manganese. Quincke, who has made very extended researches with the gas cell of Mond and Langer, stated that there are two difficulties in gas batteries; one is the complete combustion and the other is to show a continuous chain of action; he thinks Borchers has not obtained complete oxidation, and that it is not possible to consume all the gas; he thinks such a battery will not be a success very soon; he points out the difficulties in gas batteries with fused electrolytes; the solution of the problem should be one in which there is a complete oxidation of the gases.

Relation of the Capacity to the Discharging Current of an Accumulator.—L'Elec., July 24.—An abstract, with some of the data, of the article by Peukert, which was noticed in the *Digest*, June 19 (see also Aug. 14).

Production of Aluminum.—L'Elec., July 24.—A statement of the production of this metal in the large establishments. It is estimated that the output this year will be 2000 tons for the United States, Switzerland and France; the daily production and horse-power of the five large stations are given, the two in the United States being the two smallest.

Electric Bleaching.—L'Elec., July 24.—A reprint of a short article giving a general description, but containing apparently nothing new; estimates of the cost are given, with the qualification that they depend largely on the cost of the power and materials.

Meeting of the German Electro-Chemical Society.—Zeit. f. Elektrochemie, July 20.—A verbatim report of the second day's proceedings and papers; the papers are abstracted in the *Digest* under their respective headings; the business of the meeting included the adoption of the electrical units (see *Digest*, July 24), and the discussion of the question of sending a representative to America to examine and report on the subject of the development of electro-chemistry in this country; the proposition was carried; the next meeting is to be in Leipsic in April, 1898.

Ionization. MACGREGOR. Lond. *Elec. Rev.*, Aug. 6.—A brief notice of a mathematical paper from the Transactions of the *Nova Scotian Institute of Sciences*, p. 219.

Electro-Chemical and Electro-Metallurgical Industries in Europe. KERSHAW. *El'ty*, Aug. 11.—The beginning of a series of articles written for that journal, in which he will describe the rise and development of these industries in Europe; a rapid survey of the present position of these industries will be followed by more detailed accounts of those processes which are more developed in Europe than in the United States, as, for instance, the production of alkalies and bleach; the theoretical treatment of the subject will only be given when necessary for understanding the process; descriptions of patents will be conspicuous by their absence. The water-power plants of England and Germany, of which there is only one large one in each country, are briefly described. As the author appears to be well posted on this subject the series of articles will probably be of interest and value; a somewhat similar series by the same author was abstracted quite fully in the *Digest* some time ago.

Sodium.—Eng. and Min. Jour., Aug. 7.—A note stating that this metal is made by the Castner process of decomposing sodium hydroxide electrolytically, at Birmingham, England, at the rate of 2000 pounds a day, the selling price being 50 cents per pound. The cost of operation is kept a secret and very little of the metal is sold, most of it being used by the producers for making sodium peroxide and potassium-sodium cyanide.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Bolometer. KURLBAUM. Lond *Elec.*, Aug. 6; a brief abstract from the *Wied. Ann.*, 7, p. 417.—He makes the bolometer available as a source of heat of great waves length; in this way he overcomes serious difficulties heretofore encountered in measuring the intensity of the cool heat waves; when used as a source it can be brought into the same enclosure as the other, and the temperature of the source can be determined with extreme accuracy; it assumes its final temperature in a few seconds; he shows that temperature differences of 10 degrees in any region up to red heat may be measured in this manner with an accuracy of 0.1 per cent.

National Physical Labratory in Great Britain.—The English journals of Aug. 6 states that the Government has appointed a committee to report on the desirability of a national physical laboratory for the testing and verification of instruments, the construction of standards, determination of physical constants and numerical data; the chairman is Lord Rayleigh.

TELEGRAPHY. TELEPHONY AND SIGNALS.

Limits of Speeds of Working Submarine Cables. PRICE. Lond. *Elec. Rev.*, Aug. 6.—An article of a theoretical nature involving comparatively simple mathematics, to show the limits as affected by faults or leaks and by the proportions of the materials. The practical problem of working cables can be dealt with by calculation more exactly than any other engineering problem, and it does not require an experiment to determine the precise effect of intentional faults. Taking the constants of one of the Atlantic cables he makes some deductions showing the voltage required for sending certain signals and describing how this may be calculated; from this he found the results of inserting a distributed leakage; in this case a non-inductive leakage is disadvantageous; he gives the conditions for inductive leakage, illustrating the application by numerical examples; he also discusses leakage at one point and shows that with non-inductive leakage in either case the reduction of the amplitude is less at high frequencies than at low; where improvement is produced by introducing faults it appears that the relative amplitudes of the different components of the current are not as well proportioned as they might be, and that better definition might be obtained by adjusting them at the sending end without loss by a leak; the product of the capacity and the resistance affects the question of speed much more than the faults; with a simple cable the maximum speed is obtained when the ratio of the external diameter of the core to that of the conductor is equal to 1.65; the use of india-rubber would increase the speed 10 per cent.; an india-rubber cable with the core of the same external dimensions, might have an advantage of 31 per cent. in speed over the last Anglo-American cable.

The Phonograph in Telegraphy. PIERARD. *L'Elec.*, July 24.—A note describing an application of the phonograph in Spain. It appears that the telephone is there used in place of the telegraph, and it was found that the speed of transmission was greatly limited by the operators at the receiving end, who could not transcribe the messages sufficiently rapidly; at present the receiving operator repeats the message into a phonograph, from which it is then transcribed; this repetition is also heard at the transmitting end and therefore serves as a control for the correctness of the received message; the speed is 86 words per minute, which means double this amount if the return message is included. It is thought that this is the first time the phonograph has been put to this use.

Simultaneous Telegraphy and Telephony. TOBLER. *Elek. Zeit.*, July 29.—A brief extract, with the illustration, from a recent article describing the Dejongh system, which appears to be in use in Paris. The fundamental principle is old, the present writer referring to an improved form; it is for simultaneously using a metallic circuit for duplex Hughes telegraphy and simple telephone transmission; it is quite similar to the Van Rysselberghe system.

Telephone Meters. GRAETSCH. *Elek. Anz.*, July 22.—A long illustrated description, with details, of a telephone meter which counts the number of calls and the length of time of the conversation; it is placed at the subscriber's end and registers only the calls which he makes; such meters he considers the only proper solution of the problem of telephone charges.

Water Level Recorders. FINCH. Lond. *Elec. Eng.*, Aug. 6.—A reprint of a recent paper describing an instrument which has been in use at one of the Rochester water works for over three years; illustrations of the instrument and records are given.

Wireless Telegraphy. BRIGGS. *El'ty*, August 11.—An illustrated description of the Marconi system, taken apparently from his American patent; several descriptions have already been noticed in these columns.

Ader Cable Recorder.—Elec. Eng., August 12.—A reprint from *La Nature* of a brief illustrated description of the photographic recorder described in the *Digest*, July 17 and August 7.

MISCELLANEOUS.

Physiological Action on Closing a Circuit. DU BOIS. Lond. *Elec.*, Aug. 6; translated from the *Comptes Rendus*, July 12.—He describes researches made to determine whether the same muscular contraction occurs at the same voltage or at the same current; what the influence of the resistance of the body is; what the effect is of a rheostat in the main circuit for adjusting the current. He shows that the physiological effect depends much more on the voltage than on the current and that the actual resistance of a body has hardly any influence on the physiological action; a resistance in the circuit eliminates the physiological effect at closing, although the ohmic resistance is negligible compared to that of the body; the so-called non-conductive resistances still have a considerable coefficient of self-induction which can be neutralized by a condenser; the body has a large ohmic resistance but an almost negligible apparent resistance, and for this reason effects must be measured by a voltmeter and not by a galvanometer.

Ignition by the Electric Spark. KELVIN. Lond. *Elec. Rev.* and *Elec. Eng.*, Aug. 6.—A reprint from the London *Times*, in which he gives a warning to prevent the recurrence of a terrible accident which recently happened through the ignition of an inflammable hair wash; he states that the faintest electric spark suffices to ignite an inflammable mixture of combustible gases; a sufficient spark for this purpose can readily be produced by drawing the hand or a comb over very dry hair.

Substitutes for India-Rubber. TERRY. Lond. *Elec.*, Aug. 6.—He discusses the subject at considerable length and points out the dangers with which the users of india-rubber for electric purposes are threatened.

Hardened Copper. BORDEN. *Elec. Rev.*, Aug. 11.—A reprint from the Boston *Herald* describing some experiments made by Farmer many years ago; the description is not quite clear; it appears that a vessel filled with a copper salt was placed in a magnetic field and a thick coat of electrolytic

copper deposited on an object in the liquid; it was found that this copper was as hard as the hardest steel. The author also describes an experiment made by him in which he cast gray iron within the influence of a strong magnetic field, the magnetic field continuing until the mass had become cool; the casting was found to be more fibrous than crystalline, and could be hammered to a chisel edge after it is heated to a dull red, nearly as though it had been malleable iron.

Electric Furnace. Patten. *Elec. Eng.*, Aug. 12.—The first article of a series giving illustrated descriptions; the present portion is chiefly historical.

Electrical Machine-Shop Practice. Hobart. *Elec. Eng.*, Aug. 12.—The continuation of his serial in which he gives practical hints on a number of disconnected subjects.

Electric-Light Blindness.—El'ty and *Elec. Rev.*, Aug. 11.—A reprint of the reports of Hill, noticed in the *Digest*, last week.

Electrical Fittings of New Design.

The ordinary electric-light fittings have been found by practical experience to be not altogether suitable for use in connection with electric heating and other devices employed in the distribution of electric current. To meet the peculiar needs of such apparatus the American Electric Heating Corporation, Boston, Mass., has produced a line of connectors and plug switches with cut-outs combined, that is meeting with the favor of the general electrical trades for a variety of uses.

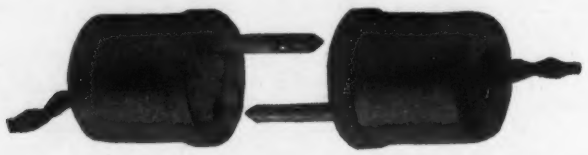


Fig. 1.

The connector (Fig. 1) is made with one plug as a part of either half, and is so arranged that it may be used as a single or double-pole device. The supports for all the conducting parts and the exterior shells are of the best hard rubber, giving high insulation and good mechanical strength. The device is especially useful on electric railways for connecting the lamp circuit of trailers. No amount of vibration can loosen the contacts or the connectors.

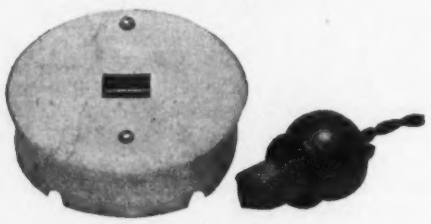


Fig. 2.

A porcelain box with an opening in the cover for the insertion of the plug is shown in Fig. 2. Within the box are suitable jaws for the plug terminal posts for line and fuses for double-pole connections. The plug is of rosewood, made in two parts which screw together. Suitable terminal posts are provided within the plug for connecting the flexible cord. Being acid-proof this box has been largely used in storage-battery work. It is rated at 15 amperes.

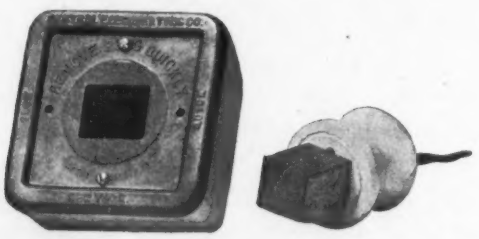


Fig. 3.

Fig. 3 represents a plug switch arranged for a double-pole line and fuse connections. The plug is almost entirely made of porcelain, proper connections being provided in the plug for the flexible conductors. The switch-box is made of porcelain with a hard rubber cover, and is arranged for a double-pole line and fuse connections.

Another design of the same device is arranged as a three-way switch to supply one or two circuits, and has a capacity of 30 amperes. The cut-outs being combined with the switches make very compact devices, all of which have been approved by the underwriters.

Arc-Light Bell Hanger.

With the increased pressures now coming into use on arc-light circuits, the customary forms of hangers are found to have too low an insulation resistance. This is especially the case with circuits of 100 to 125 lights capacity used for outdoor lighting.

The accompanying illustration shows a neat arrangement which the Western Electric Company, Chicago, provides for use in such cases. It is

Bell Hanger.

called an arc-light bell hanger. The lamp is hung from the hook in the lower bell, quite independent of the conducting wires. The latter are provided with plugs to fit into spring jacks in the lamp, enabling the lamp to be inserted or removed with the greatest ease and safety. The terminals and hook are insulated from the metallic shell of the bell, which, in turn, is insulated from the support by a water-shedding cone similar to those used in supporting trolley wires.

A New Engine Governor.

Recent developments in connection with electric lighting in office buildings insist on such exact service as to allow only the minutest variation of speed under widely varying loads and changing pressures. Not only must the speed be uniform, but it must remain so during the period of change. To meet these new and rigid requirements the Ball Engine Company, Erie, Pa., has, after months of experiment, perfected a governor which, in

Improved Engine Governor.

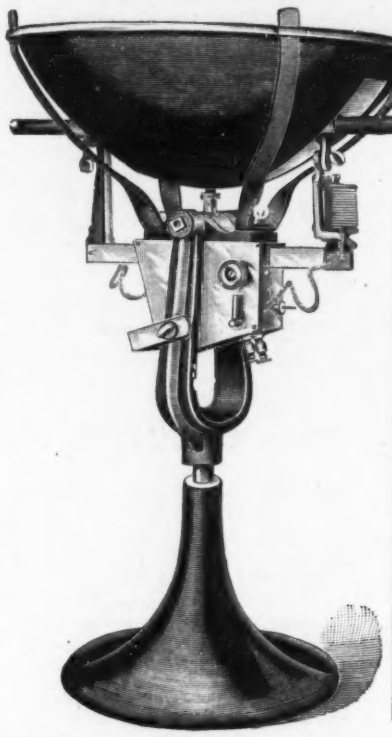
every way, fulfills the demands referred to and possesses the additional advantage of extreme simplicity. This governor is an adaptation of the Rites governor system. Not only does it regulate to the very highest degree of perfection, but with an extraordinarily rapid adjustment and with no instability or surging. This has been practically impossible with other forms of governors, on account of the multiplicity of connections, all in

rapid rotation under heavy strains and, in many cases, with improper lubrication.

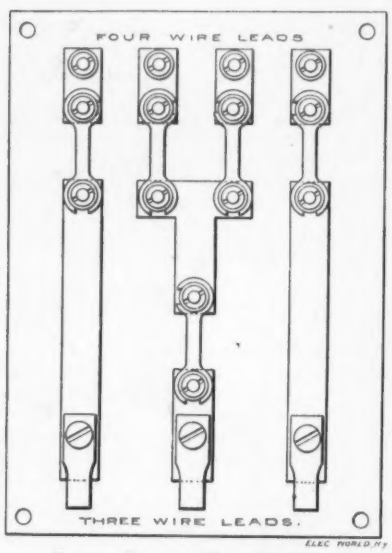
Technically stated, the centrifugal element upon which the degree of refinement of regulation in all governors depends is combined with an inertia element relatively so great that instant and extreme changes of load are immediately provided for without waiting for the manifestation of centrifugal force. The entire governor consists of but a single moving piece suspended upon one pivotal point, thereby reducing the friction to a minimum, and with no joints to interfere with its action. The suspension pin or pivotal point is made of hardened crucible steel. The eye for the suspension pin is lined with phosphor bronze, and the little lubrication that is required is accomplished through forcing grease by means of a compression grease cup into a number of recesses arranged around the bore of the bushings. The extreme simplicity of this governor, combined with the scientific adaptation of the inertia principle, will commend it to users of steam engines requiring sensitive and accurate speed regulation.

Arc Lamps for Electric Fountains.

The focusing arc lamps in the new Brooklyn electric fountain are subject to peculiarly severe conditions which required considerable extra care in their construction and installation. The lamps are operated on the 500-volt grounded street-railway circuit, and being placed in a chamber beneath the fountain are exposed to a great deal of moisture and to occasional streams of water from leaks overhead. The lamps, one of which is shown in the accompanying illustration, were furnished by Messrs. J. B. Colt & Co., New York City, and were specially designed for this work. The requirements called for operation on any voltage between 300 and 550,



ELECTRIC FOUNTAIN FOCUSING LAMP.



PANEL BOX OF NEW DESIGN.

so the lamps are grouped in sets of six in series, the reserve voltage being taken up in adjustable resistances. No part of the lamp mechanism is "alive," except the carbon holders. The insulation is of mica.

The carbons are moved by a powerful spring-barrel clock-work mechanism which is controlled by an escapement, the latter being locked or released by a magnet in shunt with the arc. The experiments conducted by the firm have shown that the maintenance of a constant E.M.F. across the arc of about 45 volts independent of the current allows of a wide variation of the current with the best distance between carbons. With the magnet adjusted to feed at 45 volts the length of the arc is about 3-32 of an inch with a current of 6 amperes, lengthening as the current rises to approximately 3-8 of an inch with 40 amperes. It is found with this arrangement that the arc automatically adjusts itself to the length best adapted to the current flowing through it.

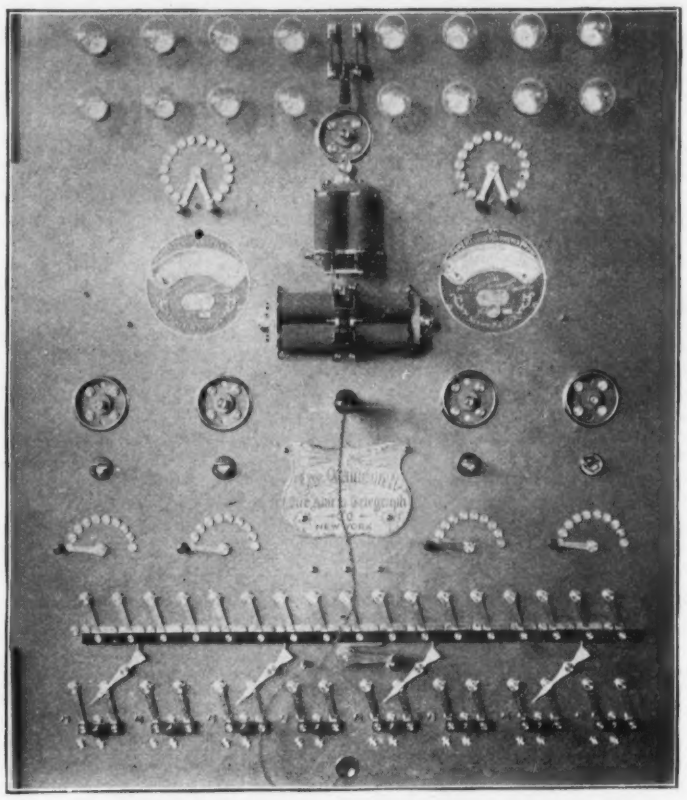
The lamps in the Brooklyn fountain are trimmed with 3-4 inch Electra carbons, both positive and negative being soft-cored. The normal current is 40 amperes.

A Novel Apartment House Isolated Plant.

There has been much discussion of late among engineers as to the advantages of isolated plants over central stations and vice versa. A new plant now in course of construction in the upper part of New York City has been designed as a happy mean between the two, with a view to combining the special merits of each. This is accomplished by the co-operative lighting of three neighboring buildings. The plant is intended to light the "Nordica," an apartment house on the corner of Seventh Avenue and One Hundred and Thirteenth Street, which has heretofore been lighted by its own plant; also the "Washington Irving," an apartment house now in process of erection on One Hundred and Twelfth Street, and a third building not yet put up. Messrs. Freedman, Rennard & Co., the constructing engineers, are installing in the power-house of this plant two 50-kw Eddy generators direct connected to Watertown engines. All conductors are carried in iron conduits with a generous distribution of outlet boxes. The distribution is on what is known as the three-to-two-wire system; and for the change-over panels Mr. L. F. Massa, of the contracting firm, has had constructed a new design, which is shown in the accompanying illustration. The central bus-bar is T shaped, the head of the T carrying two fuses to the two-wire terminals. This avoids the use of raised bars and cross-overs, with their attendant dangers of screw-driver short circuits, and also makes the box very shallow. The depth of the panel-box over-all is only three inches, which enables it to be set in flush with any wall or partition.

A Storage Battery Switchboard.

A storage battery has undoubtedly great advantages over the primary battery for fire and police-telegraph systems, but it also has peculiar dangers which must be intelligently guarded against. The Gamewell Fire Alarm Telegraph Company, New York city, has just brought out a system of storage battery supply which provides for every possible contingency.



VIEW OF SWITCHBOARD.

The control and manipulation of all the batteries and circuits is effected in a switch board, a view of the front of which is shown in the illustration.

Two complete sets of batteries are used, one of which is always charging while the other is discharging. Each set is divided into groups for the different lines, each line being provided with its own independent group, the number in the group being sufficient to generate a current of 100 milliamperes. The groups are connected with a set of gang switches at the top of the board in such a manner that they can be combined in series of 40 for charging on 110-volt circuits. In case of an emergency requiring quick recharging, or of low dynamo voltage, a movement of the gang switch sets the batteries up in series of 20. Adjustable lamp resistances are provided for accurately controlling the charging currents. The incoming current passes through a magnetic circuit breaker, the coils of which are engergized from either one of two relays. One relay is set to open the cut-out in case the charging current reverses or dies down, and the other in case the charging is too rapid. A Weston station ammeter and voltmeter are provided on the face of the board and are attached by a three-part flexible cord to a three-part plug. This plug may be inserted in three-part sockets, one of which is provided in each charging and discharging circuit. By this neat arrangement the voltage and amperage of any circuit may be readily measured by the one pair of instruments.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, August 16, 1897.

ELECTRICAL STOCKS.—Weakness characterized the market for these securities at the close of last week, fractional losses being the rule. The highest point reached by Edison Electric Illuminating of New York during the week was 125¼, at which figure it closed, the lowest being 124¼. As compared with the previous quotation, this is a net increase of 1½ points. Electric Storage Battery shows a slight decline in both common and preferred issues, and General Electric common is a trifle lower, the net loss being ½ point. The total number of shares sold of this latter stock was 22,880, and the highest price reached during the week was 38, the closing figure being 36¾, which was practically the lowest point touched. The preferred stock is ¾ higher. Westinghouse common closed at 21 bid and 23 asked, while the preferred closed at an advance of 4 points, as compared with the previous quotation.

	Par.	Bid.	Asked.
ELECTRICAL STOCKS.			
Chicago Edison Company	100	121	..
Edison Electric Ill., New York	100	..	125¼
Edison Electric Ill., Brooklyn	100	115	116
Edison Electric Ill., Boston	100	147	148
Edison Electric Ill , Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	27¼	27¾
Electric Storage, pref	100	30½	31½
General Electric	100	36¾	37
General Electric, pref.	100	80	82
Westinghouse Consolidated, com	50	21	23
Westinghouse Consolidated, pref.	50	55	56
BONDS.			
Edison Electric Ill , New York, con. 5s	105	113½	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	..	00½
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	236	238
American District Telegraph	100	..	27
American Telegraph and Cable	100	92½	95
Central and South American Telegraph	100	124	127
Commercial Cables	100	171	..
Erie Telephone	100	66¼	66½
New England Telephone	100	104½	105½
Postal Telegraph Cable	100	99	101
Western Union Telegraph	100	92⅜	92½
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	18⅛	18⅜
Brooklyn Rapid Transit	..	31	31½
Brooklyn Traction	100	..	14
Brooklyn Traction pref	100	46	48
Buffalo Street Railway	100	75	78
Cleveland Electric Railway	100	..	..
Columbus Street Railway	100	37	40
Hestonville	100	49⅞	50
Hestonville, pref	..	..	62½
New Orleans Traction	100	6	8
New Orleans Traction, pref	100	25	35
North Shore Traction	100	21	25
North Shore Traction, pref	100	82	85
Rochester Street Railway	..	13	15
Steinway Railway	..	45	50
Union Railway (Huckleberry)	..	98	110
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	93¼	93¾
West End, Boston, pref	100	100	100½
Worcester Traction	100	17	19
Worcester Traction, pref.	100	90	93
BONDS.			
Brooklyn Rapid Transit 5s, 1945	100	88	..
*Buffalo Street Railway 1st con. 5s	100	109	111
Cleveland Electric Railway 1st mtge., 5s	100	102	104
*Columbus Street Railway 1st 5s	100	94	97
Rochester Street Railway 1st 5s	100	..	85
Union Railway (Huckleberry) 1st mtge. 5s	..	106	108
*Westchester Electric 1st mtge. 5s	100	100	103

*With accrued interest

TELEGRAPH AND TELEPHONE.—With the exception of American Bell Telephone this class of securities showed continued strength during the last week, the quotations being in most cases a trifle higher. American Bell receded 1½ points, while Western Union gained 1⅛, closing at 92⅜. The highest figure reached by Western Union was 93¼, and the lowest 90⅝. There was considerable activity in this stock, the total number of shares sold being 102,489. Erie Telephone shows a substantial increase, as does American Telegraph & Cable.

ELECTRIC TRACTIONS.—The activity in this list during the past week was rather slow, although prices, as a rule, slightly advanced. Notwithstanding a report of decreased earnings for the quarter ending with June, the Buffalo Railway stock advanced about 2 points on very slight offerings. Columbus Street Railway stock was inclined to be heavy at about the figures of last week. The continued decrease in earnings which the company reported was accounted for by the fact that as the city is one of the best paved in the country the bicycle competition was more than usually severe. The report for July showed a loss of $4,377 in gross receipts, but a saving of $896 in operating expenses reduced the net decrease to $3,281. New Orleans and North Shore Traction both reacted fractionally on reports of falling off in receipts for July. The local street railway issues were all quiet and unchanged. Brooklyn Rapid Transit closed at 31½, which price is only ⅛ point above the lowest quotation reached during the week, while the highest figure reached was 34. The number of shares sold was 9725.

FINANCIAL REPORTS.—The Edison Electric Illuminating Company of New York reports gross earnings for July of $162,453, an increase of $5562, as compared with the same month of last year, and net $59,034, an increase of $1,767. For the seven months ending July 31 the gross earnings were $1,391,219, an increase of $128,423, as compared with the corresponding period of last year, and net $630,749, an increase of $88,943. The Buffalo Railway Company reports for the quarter ending June 30 gross earnings $315,178, a decrease of $30,177, as compared with the gross earnings for the same period last year; operating expenses, $156,926, a decrease of $20,926; net earnings, $158,252, a decrease of $9,251; surplus, $55,971, decrease, $14,631.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, August 19, 1897.

THE WESTERN ELECTRIC COMPANY'S NEW BUILDING.—The Western Electric Company has moved its New York offices to its new building at 57 to 67 Bethune Street, near West Street. The company has also opened a store at that address for the sale of its manufactures and other electrical supplies, and will continue the retail store in the old building on Thames Street.

AN ELECTRICAL FISHING PARTY.—By invitation of the Safety Insulated Wire & Cable Company, a party of distinguished electricians and electrical business managers spent last Wednesday fishing off the coast below Sandy Hook. The party was conveyed down the harbor on the famous yacht "Hildegarde," once the property of the Prince of Wales. Off the Hook those who wished to fish were transferred to fishing sloops, while for those who did not care for piscatorial amusements entertainment of another nature was provided. All who had the good fortune to be invited reported having greatly enjoyed the abundant hospitality of Mr. L. F. Requa and his company.

AN ELECTRICAL RAT TRAP.—Mr. George Kirkegaard, a well-known electrical engineer, has invented an electrical rat trap that is said to be a real success in captivating these pestiferous rodents. Mr. Kirkegaard uses live chickens as bait, but as they are kept in a separate enclosure, which forms a part of the trap, they cannot be molested by their hungry enemies. In one night 123 rats were caught in one of these traps placed in a downtown restaurant. Mr. Kirkegaard says he can make traps to catch bears, wolves and other wild animals. Mr. Kirkegaard's address is Tompkinsville, Staten Island, N. Y., and it is his intention to organize a company to put the trap on the market.

BRIDGE ENGINES FOR SALE.—The Brooklyn Bridge Trustees advertised for bids for the steam locomotives, which were relegated to oblivion by the introduction of electric cars for switching purposes on the Bridge. There is evidently no demand for steam locomotives, because the only bid received was so low that the Trustees decided not to part with the engines until further offers were received. There are eight of these engines in all, but one of them will be retained for emergencies and the other seven will be sold. It is stated that there is a glut of old engines in the market, and that the Trustees will not find it an easy matter to get rid of the retired machines except at a great sacrifice. The bridge engines cost, on the average, about $4000 each.

ELECTRICAL TRADE WITH SOUTH AMERICAN COUNTRIES.—Reports from Buenos Ayres as to the prospects developing in that market for electrical apparatus and machinery indicate an encouraging outlook, according to

the New York Journal of Commerce. An agent of a local manufacturing concern, in recent correspondence, states that if all the isolated plants that are contemplated, not only in Buenos Ayres but in the surrounding large towns, are contracted for, there will be considerable business to look forward to. The American electrical companies, he states, are well prepared to compete in that market. Among the assorted cargo of the steamer "Bellenden," which sailed from this port recently for Buenos Ayres, were 103 cases of electrical machinery, valued at $38,855. There were also 95 packages of motor cars, valued at upward of $11,000. Arens Brothers, of Rio Janeiro, have just received a contract for a good-sized isolated electric light plant, the equipment for which advices state they will shortly have to purchase.

PROGRESS OF THE RAPID TRANSIT PREPARATIONS.—The Rapid Transit Commission, of New York City, is gradually working through the legal difficulties which must be disposed of before construction can be commenced. The commission appointed by the Appellate Division of the Supreme Court to determine upon the practicability of the plans is now holding meetings and cross-examining Chief Engineer W. B. Parsons. The commission will not decide upon the kind of motive power to be used. That decision rests with the operating contractor, the only requirement being that there shall be no combustion in the tunnel. Mr. Parsons, however, in calculating loads and speeds, has assumed the use of electric power and estimated that six-car trains can be run on the express tracks at the rate of 35 miles per hour, including stops of fifteen seconds at stations 1½ miles apart. Local train speeds he estimated at 15 miles an hour, with stations at one-quarter-mile intervals. Such a service will, he states, require much more power per ton load than is now customary in traction work, but will be advisable because of the increased mileage obtainable, and, what is more important, the increased satisfaction of patrons of the road.

LORD KELVIN IN AMERICA.—A distinguished visitor arrived at New York on the Cunard steamer "Campania" on August 13, in the person of Lord Kelvin, who was on his way to attend the meeting at Toronto of the British Association for the Advancement of Science. Lord Kelvin was accompanied by Lady Kelvin, who stood beside her husband on the bridge as the steamer was warped into her dock. Lord Kelvin was easily recognized, although his face shows his age more distinctly, and his beard seems to be whiter than his pictures indicate. He seemed to take great interest in watching the passengers disembark and the attendant lively scenes on the dock. It was noticed that he was a little bit lame, and carried a stout walking stick to aid him in walking. This is Lord Kelvin's second visit to America, the first one being the occasion of the meeting of the association in Montreal in 1884. He said that he had come across the ocean at this time largely to observe, although he intended to read a paper at the Toronto meeting. He expressed much interest in some of the latest developments in electrical science in this country. Lord and Lady Kelvin did not remain long in New York. They left for Niagara Falls on the morning of August 14, and it was Lord Kelvin's intention to stay at the Falls long enough to enable him to inspect the power plants and other points of electrical interest, and then go direct to Toronto. After the meeting it is his intention to go to Vancouver, "simply to see the country," he said. He could not state when he would return, although he intimated that his journey across the country would cover considerable time.

MICA IN LARGE SHEETS FOR INSULATION.—The uses of mica in the electric arts have steadily grown since this material was first used for insulation. Its extreme lightness, high insulation properties, and fireproof character have rendered it one of the most valuable materials in the hands of the working electrician. A great difficulty which has stood in the way of its more general use has been the expense connected with obtaining mica in large sheets. The pricee of this material in the market depends almost entirely upon the size of the pieces, its value ranging from a small amount per pound for scraps and small pieces to many dollars for an equal quantity of large and perfect sheets. It has consequently been very desirable to find mines of this mineral in which the crystallization is so perfect that large and flawless sheets can be readily obtained. Mr. Antonio Navarro, of this city, has recently put upon the market specimens of various grades of mica which unite in a remarkable manner the qualities of great transparency, high flexibility and insulation, with unusual size of the individual pieces. Mr. Navarro is the general agent for North America and Europe for the mine from which this mica comes. It is understood that this mica is to be vigorously pushed upon the American market. It is to be hoped that the appearance of these new grades of this important insulating material will prove a stimulus to the more general use of mica in the electrical trades, where its long recognized merit has already caused its general adoption, despite the high expense attendant upon its use.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., August 16, 1897.

THE AMERICAN OIL COMPANY, Providence, R. I., has for five years provided a summer outing for stationary engineers, which it very appropriately terms a reunion of this fraternity. The occasions have always been such as to impress most pleasant remembrances and are looked forward to with happy anticipations. This year's reunion occurred on August 14. It included an inspection in the evening of the spacious works of this company, which were kept in full operation, a moonlight sail down Narragansett Bay, supper at Field's Point, after which the sail was continued, via Fall River, to Providence, arriving about 2 A. M. Sunday. About 550 engineers availed themselves of the privileges of this reunion, which certainly emphasizes the regard and esteem of the profession for the officials of this company and its products.

THE ELECTRIC CLUB, of Boston, through its officers and a Committee of Arrangements, provided a memorable treat for its members on August 14, in the form of an excursion by steamer to Bass Point, Nahant, and a dinner there at the Bass Point Hotel. About fifty members participated, and a most enjoyable outing was experienced. President S. A. D. Forristall, superintendent of telegraph of the Boston & Maine Railroad Company, presided at the dinner and officiated at the entertainment in the hotel parlors following the dinner. Commissioner of Wires Thos. W. Flood, Capt. Wm. Brophy, chief electrician of the Wire Department, Boston, ex-Fire Commissioner Robert G. Fitch and R. F. Ross, New England manager of THE ELECTRICAL WORLD, were present at guests. This organization has a membership of over 100, composed principally of telegraph and telephone officials and employees, and its dinners and entertainments every three months are always interesting and well attended.

BUFFALO AND WESTERN NEW YORK NOTES.

BUFFALO, N. Y., August 16, 1897.

MORE LAMPS WANTED.—The Common Council of Niagara Falls has decided to advertise for bids for supplying the city with 300 more arc lights for five years, a certified check for $10,000 to accompany each bid.

NEW CONDUITS.—Messrs. J. G. White & Co., of New York, are laying in Niagara Street, Buffalo, a twenty-five-duct conduit for the local company that is to distribute Niagara power throughout the city. The work is under the superintendence of Mr. W. C. Burton. It is expected that the current will be ready by October 1.

LARGE STATIC MACHINE.—The Buffalo Electric Sanitarium has just received a mammoth new static machine, made by Van Houten & Tenbroeck, of New York. It was made from specifications furnished by Dr. John T. Pitkin, of the sanitarium, and will be used for the treatment of chronic diseases, It generates very high voltage by the revolution of its twenty great plates.

NEW ELECTRICAL ORE SEPARATOR.—David Telfair, of Olean, has invented a new electrical apparatus for separating gold from the ore, and a company has been formed to use it in the old worked-out mines of Colorado. It is claimed that its use will enable its owners to obtain gold in paying quantities from ore that has been worked once. Some of the stockholders are Buffalonians.

PITTSBURG NOTES.

PITTSBURG, Pa., August 16, 1897.

THE HOME TELEPHONE COMPANY GETS AN INNING IN ALLEGHENY.—The ordinance granting rights of way to the Home Telephone Company, in Allegheny, which has been struggling for passage through Councils for nearly a year, was at last acted upon by the Committee on Corporations on August 13. After the reading of an opinion from the City Solicitor to the effect that the Home Company was regularly chartered under the laws of West Virginia, and had complied with the formalities required to enable it to do business in the State of Pennsylvania, and after some discussion, the ordinance was finally recommended for passage by Councils, and was ordered printed.

GOOD CAR SERVICE FOR PITTSBURG.—The Consolidated Traction Company is making excellent progress in the reconstruction of its lines, and will soon have its comprehensive system in complete operation on the plan proposed when the consolidation of all the lines running to the East End was effected. One of the noteworthy features of this plan is the "loop" system of operation that will be introduced on the Fifth Avenue and the Penn Avenue branches. All cars coming into the city by way of Fifth Avenue will run through Cecil Alley to Penn Avenue, and return toward the East End on that street. At various points between the city and the Wilkinsburg line cross routes will be established by means of which these cars will find their way back to Fifth Avenue and run into town again on that thoroughfare. Conversely, all cars coming into town on Penn Avenue will run through Cecil Alley, and out toward the East End on Fifth Avenue, getting back to Penn Avenue by way of the cross-town lines, and into the city again on Penn Avenue. Thus a passenger taking a car at any point on the loop may return to his starting point without changing cars, no matter whether he takes an east-bound car or one going west. The longest loop will extend out to Wilkinsburg, being completed by way of Frankstown and Hamilton Avenues. If the Traction Company can come to an agreement with the Wilkinsburg Council the loop system may be extended into that borough, but for the present a 7-cent fare and a transfer will be required, as before, from Wilkinsburg passengers. The cable conduit on Penn Avenue has all been removed, and the new tracks and overhead work are about ready for use. The conecting tracks through Cecil Alley are being laid, and by the end of the present month everything will be ready for the complete inauguration of the system described above excepting the rebuilding of three bridges crossing the Pennsylvania Railroad tracks in the East End. The contracts for these bridges have just been awarded, and the cost will be divided between the city and the Consolidated Traction Company. It is expected that they will be completed within sixty days.

CHICAGO NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., August 16, 1897.

MR. WILLIAM WRIGHT has severed his connection as manager of the Chicago Armature Company to take the general Western agency for the E. G. Bernard Company, Troy, N. Y. Mr. Wright's offices are at No. 939 Monadnock Building, Chicago.

THE CHICAGO EDISON COMPANY has been the victim of wire thieves lately, and as a result of these depredations it is minus 2500 feet of cable along Milwaukee Avenue. These thefts have covered a period of a few months, and the detectives are on the lookout for the culprits, who are supposed to be several men who represented themselves to have been employees of the city. As yet the police have been unable to find any trace of the thieves.

MR. WALTER C. McKINLOCK has opened a general electrical merchandise office in the Fort Dearborn Building in this city, and is open to negotiations with manufacturers to represent them and sell their goods in this section. Mr. McKinlock has a large and first-class personal acquaintance with most all of the station superintendents, owners and contractors in Chicago and the West, and should be a valuable man for those seeking an outlet for their goods.

He desires a line of merchandise or specialties. Mr. McKinlock has had fifteen years' experience on the road and is well posted in the art of advertising goods.

THE CITY ELECTRICAL REPAIR SHOP.—Mr. E. B. Ellicott, superintendent of city telegraphs, has closed the city electrical repair shop. This action on the part of Mr. Ellicott has been criticised by some because it has thrown the business to a concern for which he once worked. In his own defense he gives figures to prove that he was governed solely by motives of economy. The annual expense of the shop amounted to nearly $25,000, and it occurred to him that the work could be done at much less cost. The closing up of the shop was the result. Mr. Ellicott intimated that the work for the city might be divided among half a dozen companies.

Southern Notes.

RICHMOND, Va., August 16, 1897.

GOLDSBORO, N. C.—There is talk of building an electric road from this place to Seven Springs, a distance of 13 miles, for which purpose $17,000 has already been subscribed.

NEW TELEPHONE COMPANY.—The Albemarle Telephone Company was organized on August 9 at Charlottesville, Va. The company expects to have its line in operation at an early day.

PROPOSED ELECTRIC RAILWAY.—Mr. J. E. Willard, of Fairfax, has made a proposition to the citizens living between Falls Church and Vienna to build an electric road from Vienna to Fairfax Courthouse, if they will build the portion from Falls Church to Vienna.

THUNDER AND LIGHTNING BY TELEPHONE.—Mrs. Frank E. Cornett, who lives at Laurel Springs, near Raleigh, N. C., does not like to have the telephone wires near her property. She has a habit of cutting down telephone poles as fast as they are erected upon her land, saying that she does not intend that thunder and lightning shall pass her home on a telephone wire.

ELECTRIC ELEVATOR FOR THE CAPITOL.—Bids have been opened in the office of the architect of the Capitol at Washington, for a new elevator to replace the one now in use at the end of the west corridor on the Senate side of the building. Congress at the last session made an appropriation to replace it with a more modern elevator. Two bids were received, one from the Sprague Electric Elevator Company, of New York, and one from the Otis Elevator Company, of New York. The bid from the Sprague Company was $3685 for a modern elevator of 4500 pounds capacity, constructed so that the speed might be regulated anywhere between 1 foot a minute and 250 feet a minute. As this was the lower bid it will probably be accepted. The Otis bid was $4220 for a hydraulic elevator and $4370 for an electric elevator.

St. Louis Notes.

ST. LOUIS, Mo., August 16, 1897.

WITH A NAME, BUT NO EXISTENCE.—The City Register is trying to locate the United Lines Telegraph Company, and the Pacific Mutual Telegraph Company, in order to collect the taxes from them. The notices sent to them were returned marked "No record of address." The United Lines Telegraph Company has been assessed unavailingly for a number of years. The Pacific Mutual Telegraph Company has been assessed this year for the first time.

ELECTRIC RAILWAY EXTENSION.—The extension of the East St. Louis Electric Street Car Line will probably be completed some time next spring. The ordinance requiring that the work should be commenced within sixty days from its passage and completed within one year will be carried out. The grading only will be completed, however, this fall, and the laying of the rails next spring after the frost is out of the ground. The extension will be completed in time for the summer business.

Colorado Notes.

DENVER, Col., August 13, 1897.

DECAYED POLES IN DENVER.—The City Electrician of Denver, M. L. Stern, has been making an inspection of the electric light and telegraph poles in the city. He has found many in the residence district that are so badly decayed that their removal will be insisted upon. The inspection grew out of an accident in which a woman was struck down and killed by a falling pole in the business district.

COST OF ARC LIGHTS.—Some weeks ago the Common Council of Denver appointed a special committee to ascertain the cost of lighting in cities having a population about the same as that of Denver. It was learned that in twelve cities the cost of gas per cubic foot averaged $1.28. In twelve cities the average cost of arc lights was found to be $104.05 each per annum, as shown by the following figures in the committee's report:

CITIES.	No. of Lights.	Price Per Annum.
Milwaukee	1175	$ 90.50
Newark, N. J.	1565	98.55
Jersey City, N. J.	1000	99.00
Louisville, Ky.	1218	84.00
Omaha	236	114.50
Rochester	2240	91.25
Kansas City	202	110.00
Providence, R. I.	1800	127.75
Albany, N. Y.	650	122.40
Syracuse, N. Y.	943	91.25
Worcester, Mass.	504	120.45
Toledo	760	90.00

THE CANON CITY AND CRIPPLE CREEK ELECTRIC RAILWAY.—Work has been commenced on a 5-mile section of the electric railway to be built from Canon City to Cripple Creek, by Messrs. Orman & Cook, railroad contractors. The line will be 25 miles in length, and the grade will be almost continuous, though not greater than that found on nearly all steam railways operating in the mountains. Plans for the power plant and equipment have been completed and it is said no time will be lost in the work of installation. The road is designed to transport both freight and passengers. It is expected that large quantities of ore will be hauled to Canon City for treatment, and that the new line will carry from the coal mines at Canon City a considerable proportion of the fuel required in the mining camps of Cripple Creek and Victor. Power plants will be located at Canon City and at Marigold, and current will be supplied to the public for power and lighting, in addition to that required for the operation of the road. The enterprise has been undertaken by the Canon City & Cripple Creek Electric Railway Company, which is capitalized at $1,000,000, and was incorporated by James J. Cone, Lyman Robison, Thomas S. Wells, T. M. Harding, J. H. Peabody and J. H. Harrison. It is said that the money necessary for the construction of the road has been raised in New York.

Pacific Coast Notes.

SAN FRANCISCO, Cal., August 16, 1897.

TAXING ELECTRICAL COMPANIES.—The Board of Supervisors of Fresno County, Cal., has imposed a license of $100 a year on all gas or electric companies having gross receipts of $6000 or more per year; where receipts are less than $2000 a year the license is $20 a year. Telephone companies will have to pay $100 a year.

ITS FULL OUTPUT NOW AVAILABLE.—The Nevada County Electric Company has had three additional Pelton wheels installed in its power station, which enables the Stanley two-phase generators to be worked up to their full overload capacity. The alterations were made under the superintendence of Mr. Hunt, of Hasson & Hunt, consulting engineers, San Francisco.

AN INTERESTING WATER-POWER PLANT.—The Blue Lakes Water Company has made preliminary tests of its new electric-power station, and the towns of Mokelumne Hill and San Andreas, Cal., are being lighted from the 2000-volt, two-phase current supplied by one of the Stanley generators. The wheels are driven by water brought 43 miles by the famous Mokelumne Ditch. The long-distance transmission lines will be operated when the transformers are installed.

THE SPRECKELS BEET SUGAR PLANT, now in course of construction, near Salinas City, Cal., will have, to begin with, two direct-current generators of 400 kilowatts each, for electric power purposes, a lighting dynamo of at least 100-kw capacity, and a large number of motors. The main building will be 100 by 586 feet, and five stories in height. Three thousand tons of beets will be crushed daily, and the daily output of refined sugar will be 450 tons. The space required for the fifteen beet bins is 20 acres.

MODERN MINING PLANT.—The General Electric Company has completed its contract for installing a modern mining plant for the Diamond Hill Gold Mines, Limited, in Montana. Line-Foreman Jewett, of San Francisco, was in charge of the work. The apparatus installed includes one 500-kw multipolar dynamo, which generates current at a pressure of 2080 volts, three induction motors (2080-volt) having a capacity of 125 horse-power each, one induction motor of 50 horse-power, two 30-hp motors (220-volt) for the concentrator, and a number of additional motors for batteries, air-compressors, and rock-crusherr. The contract includes, also, an extensive lighting system.

General News.

The Telegraph and Telephone.

SUN PRAIRIE, WIS.—A new telephone line will be built between Columbus and Portage.

RED WING, MINN.—The extension of the Pierce County telephone system to Prescott is now completed.

DES MOINES, IA.—The Martin Telephone Company has just completed its line to Story City and Randall.

NASHVILLE, TENN.—A telephone exchange will be established at Corbin by the East Tennessee Telephone Company.

MILWAUKEE, WIS.—The Pierce County Telephone Company has men at work extending its line from Ellsworth to Prescott.

PULASKI, VA.—A new company has been formed to build a telephone exchange in this place, and bids fair to be a success.

MILNOR, N. DAK.—The Forman Telephone Company has completed arrangements to extend its line from Cayuga to Wahpeton.

CENTREVILLE, TENN.—The Cumberland Telephone Company is making preparations to extend its lines from Columbia to this place.

DETROIT, MICH.—The Bell Telephone Company has reduced its rate between Detroit and Wyandotte to 10 cents for five minutes' conversation.

ABERDEEN, S. DAK.—The Dakota Central Telephone Company, whose headquarters are in this city, is rapidly extending its lines in various directions.

YOUNGSTOWN, OHIO.—The Youngstown Telephone Company is contemplating putting a new system into its plant and a new and more improved switchboard.

NEW BALTIMORE, MICH.—The Bell Telephone Company is putting in metallic circuits, and has reduced its rates to meet those of the new State Telephone Company.

DUNDEE, MICH.—The new State Telephone Company will open an exchange here, and its charges will be 15 per cent. lower than those of the Bell Company, which maintains a State office at this place.

CLYDE, OHIO.—The new telephone system, which has been established here by local capitalists, has been opened for business. There are nearly 100 subscribers, and the system is said to be working with entire satisfaction.

DURHAM, N. C.—The Southern Bell Telephone Company at Durham is

giving free service, in an effort to squeeze out the opposition company. It has also reduced rates at Winston-Salem, N. C., to $12 and $16 per year.

BUCYRUS, OHIO.—The County Commissioners have granted a franchise to the Suburban Telephone Company for the erection of a telephone line through the northern part of the county, and work on the same will be commenced at once.

BENTON HARBOR, MICH.—The Twin City Telephone Company is making rates of $12 and $16 a year for private and business houses, respectively. The Bell company is soliciting for $6 and $12 rates, and is offering these on fifty-year contracts.

BUCYRUS, OHIO.—The County Commissioners have granted to James T. Cartin, of Lykins, permission to construct a telephone line in the northern part of this country. The contemplated line is to run to New Washington and Chatfield, and thence to Lykins.

ALBUQUERQUE, N. MEX.—The Postal Telegraph Company has been making rapid progress in the South in the extension of its lines into Mexico. A line has been built across Texas from New Orleans to Fort Worth, and the company is now running its wires to El Paso on the way to the City of Mexico.

ATHENS, MICH.—No other town in the State the size of Athens can boast of five telephone companies. Everybody here has the "hello" craze, and the streets are filled with poles and wires. The companies operating here are the Bell, Snyder & Doran, F. T. Bisbee, D. Eldred and W. Van Middlesworth.

MONROE, MICH.—The new State Telephone Company has completed connections between here and Detroit, and service has been inaugurated. A rate war will follow, as the new company charges but 10 cents to Detroit. The Bell company, it is said, will cut to 5 cents. The new exchange has 125 subscribers.

HOUSTON, TEX.—The people of Tishomingo are moving to try to get the telephone line built from Durant to Tishomingo and Paul's Valley. The owners of the line say the cost of construction would be too great for the amount of business that could be done, and would ask quite a bonus for putting in such line.

HARTFORD, CONN.—The Southern New England Telephone Company will soon introduce in Hartford an electric burglar system similar to the one in operation in New Haven. The burglar alarm system is adapted for places where night watchmen are employed. The system is intended as an adjunct to the work of a watchman.

CHICAGO, ILL.—A portable bedside telephone for the use of physicians in answering their numerous night calls is the latest device provided by the Chicago Telephone Company. It permits the medical man to respond to every night call without leaving his bed. About thirty of these instruments are now in use by as many Michigan physicians.

DETROIT, MICH.—The Michigan Telephone Company has filed a mortgage for $750,000, covering all the real estate and telephone plants of the company in this State. The mortgage is in favor of the Guarantee Trust Company, of New York, and will bear 5 per cent. interest, to be paid in gold bonds at the office of the Guaranty Trust Company, July 1, 1917.

CARO, MICH.—The Moore Telephone Manufacturing Company of this place has secured a franchise to construct and operate a telephone exchange at Vassar. From Vassar a line will be run by way of Reese to Saginaw, where it will connect with the Valley City Telephone Company, which will have an exchange in operation at Bay City and Saginaw in about three months.

DETROIT, MICH.—The Michigan Bell Telephone Company announces that after October 1 next, the price of its residence telephones will be reduced to $24 per year. The former prices ranged from $50 to $100. This move is said to be the result of the competition of the new Detroit Telephone Company, which made a rate of $25 a year on residence 'phones on the three-year contracts, or $30 on shorter time.

SIOUX CITY, IA.—The Home Telephone Company has completed its line along the Omaha to Wayne, making the ninth office of this system which has been established in Northeastern Nebraska with connections with Sioux City, and there are several others which will be reached this season. The work will be pushed on all summer by this company and the allied independent companies which are building in all directions from Sioux City.

NEW HAVEN, CONN.—The Western Union Telegraph Company is rebuilding its lines between New York and Boston, and is using copper instead of the old iron wires, which are being taken down. The company has gangs of men out stringing the wires, and it is expected to have an entire new set of wires in use within a few months. Already there are two or three copper wires in working order between this city and New York.

FREDERICK, MD.—The annual meeting of the Interstate Telephone & Telegraph Company was held in Frederick, Md., July 28, all the stock of the company being represented. The following Board of Directors was elected: Gen. L. A. Carr, of Durham, N. C.; Hon. J. S. Carr, of Durham, N. C.; Mr. Geo. W. Watts, of Durham, N. C.; Mr. Robert L. Carr, of Baltimore, Md.; Mr. Edgar L. Miller, of Frederick, Md.; Mr. James E. Walker, of Frederick, Md.; Mr. Peter D. Fahrney, of Frederick, Md. The new board elected the following officers: Lewis A. Carr, president; Dr. P. D. Fahrney, vice-president; J. S. Carr, treasurer; W. W. Shaw, secretary and auditor; Edgar L. Miller, general manager. Business of routine character was attended to and the board adjourned. The report of President Carr shows the company to be in a flourishing condition, and recommended the building of a number of exchanges and long-distance lines.

ELECTRIC LIGHT AND POWER.

SALINEVILLE, OHIO.—The council of Salineville voted to light the town by electricity. Bids will be asked for.

SANBORN, IA.—Elias W. D. Snider, proprietor of the Sanborn Roller Mills, will put in an electric plant to light the village.

EAGLE RIVER, WIS.—The contract has been let to F. J. Thrun to put in an electric plant in connection with the water system.

MIDDLETOWN, OHIO.—Sam Woodward, of Franklin, purchased the Middletown gas and electric light plants, which were sold at auction for $33,000.

McCOMB, OHIO.—Mr. Richey, of Bloomdale, has been granted an electric light franchise, and has purchased grounds for the plant, which will be erected as rapidly as possible.

CAREY, OHIO.—Messrs. W. J. Hayes & Son, of Cleveland, were the highest bidders on the 6 per cent. $10,000 bonds to be issued by this town for the purpose of constructing an electric light plant.

CUMBERLAND CITY, MD.—The Cumberland City Council has authorized the employment of an electrical engineer to make plans for and supervise the erection of an electric lighting plant, not to exceed in cost $19,000.

FORT WAYNE, IND.—Mr. C. L. Olds has been awarded the contract by the city of Decatur to build a complete electric light station, equip it with machinery and turn it over to the authorities for the sum of $14,875.

JACKSONVILE, FLA.—A petition was presented by many property owners asking the Council to take immediate steps for the issuing of bonds to raise sufficient funds for the erection of an electric light plant to be owned and operated by the city.

JOHNSON CITY, TENN.—The Watauga Lighting & Power Company has decided to build a dam across the river at Johnson City, and to convert the power thus secured into electric power, which will be used for all purposes. The improvements will cost $15,000.

NIAGARA FALLS, N. Y.—Bids will be received by the City Council until November 1 next for the exclusive furnishing of electric arc lights to this city for a period of five years, from November 1, 1898, according to specifications on file with the City Clerk. Further information will be furnished on application to Mr. S. F. Arkush, City Clerk.

TITUSVILLE, PA.—The Titusville Electric Light & Power Company has brought a suit in equity against the city of Titusville, asking to restrain the city from further increasing the capacity of its electric plant to furnish more light for the city, the plaintiff claiming that the city entered into a contract to receive light from no other source.

EPHRATA, PA.—The Borough Council has awarded the contract to F. E. Bailey & Co., Philadelphia, for lighting the streets of this place with twenty 3000-cp long-burning arc lamps, to run until midnight, at $65 per year per light. A company has been organized and a site secured for the location of the plant, and work on the same will be commenced at once. The plant will have a capacity of thirty arc lights and 1000 incandescents.

THE ELECTRIC RAILWAY.

YORK, ME.—A new railroad is being contemplated for York County in the near future.

ASHLAND, OHIO.—New London and Londonville will probably soon be connected by an electric road.

BUFFALO, N. Y.—An application is being made for a franchise for a new electric railroad for Grand Island.

LOWELL, MASS.—The Fitchburg, Ayer & Lowell Electric Railway Company is contemplating new extensions to the road.

WOODBURY, PA.—A trolley road will be constructed from Woodbury to National Park, on the Delaware, next spring.

CHAMBERSBURG, PA.—A New York syndicate failed to file its bond and forfeited its right to erect a trolley line at Chambersburg.

WEBSTER, MASS.—The project of building an electric railway to connect Webster and Dudley is being agitated. Edgar S. Hill is interested.

BALTIMORE, MD.—A movement is on foot to extend the Baltimore & Washington Transit Electric Line from Sligo Park to Sandy Spring.

WORCESTER, MASS.—Harold Parker, of Clinton, is considering a scheme for the construction of a street railway between Worcester and Webster.

AUBURN, MASS.—The residents of Auburn want to be connected with Worcester by an electric railway, and the matter is now being discussed.

FLOURTOWN, PA.—Recent movements indicate that the trolley line will shortly be extended up the Bethlehem Pike from Chestnut Hill to Flourtown.

GREENSBURG, PA.—Col. Hugh Keogh, of Lancaster City, has revived the electric street railway enterprise from Derry to Latrobe, and he states that the road will be built this fall.

SOUTH BETHLEHEM, PA.—Hugh E. Crilley, of Pascoe & Crilly, who are the projectors of the Hellertown & South Bethlehem trolley road, has petitioned the Council on the matter of building a new road.

WASHINGTON, PA.—A party of promoters from Baltimore have been in conference with the Township Trustees, with a view of acquiring the right of way for a trolley line in Washington Township through the Blue Mountains.

EAST LIVERPOOL, OHIO.—The new North Side Electric Railway Company made application for franchise to the City Council for the new North Side loop line to run 6 miles through the suburbs. The line will cost $80,000.

SPRINGFIELD, MASS.—The final location of the line of the Springfield & Southwestern Electric Street Railway Company in the town of Agawam has been settled. Two power houses will be built, one probably in West Springfield, and the other in the vicinity of Suffield.

CHICAGO, ILL.—A decree of sale has been entered by Judge Showalter directing United States Master in Chancery Bishop to sell the effects of the Englewood & Chicago Electric Street Railway Company. The decree was granted after a bitter contest on behalf of the minority bondholders.

AKRON, OHIO.—Contracts have been let for the grading of the new Cleveland & Akron electric railway and the work will be pushed rapidly. It is thought that cars will be running on the new line carrying passengers to Cleveland before winter sets in. The new line passes through Ghent and Brecksville.

LEXINGTON, MASS.—Several prominent citizens of Lexington and other

places have formed an organization and will apply for incorporation for the purpose of building an electric street railway from North Lexington to Arlington Heights, Capital stock of the company is $150,000; directors, L. A. Saville, Chas. E. Dresser and Chas. Cummings.

HAMMOND, IND.—The Hammond City Council has granted to Malcolm T. Hart, John Brown, Lyman D. Wolf, John G. Strabel and Robert Bates the right to construct a street railway into this city. The franchise is for thirty years, and requires the company to have its line in operation within two years. The line will come up from Cedar Lake, via Crown Point, Griffith and Highlands, thus connecting the northern and southern portions of the county. The promoters are said to be wealthy citizens of Crown Point.

BALTIMORE, MD.—The receivers of the Baltimore & Catonsville Construction Company, which contracted to build the first electric railway between this city and Washington, have been discharged by the court. The reorganization committee of the railway company will immediately resume construction work. When the company failed it carried down with it the railway company, as the construction company had pledged to it all of the stock of the railway company—8000 shares—and some $5,000,000 of the bonds. The debts have been paid, or at least a settlement has been made, so as to place both companies on their feet. It is understood that the remaining bonds, only $2,300,000 of which were issued, and the stock of the company will be used to borrow money for the completion of the road.

Trade and Industrial Notes.

THE OHIO STORAGE BATTERY COMPANY has removed its office and shop to 73 Champlain Street, Cleveland, Ohio.

THE NEW METROPOLIS THEATRE, at the corner of 142d Street and Third Avenue, New York City, will be fitted with dimmers of 1000-lights aggregate capacity, made by the Iron Clad Rheostat Company, and supplied by Mr. Chas. D. Doubleday. The theatre will open August 30.

BATTTERY COMPANIES COMBINE.—We are informed that the Law Battery Company has been leased by the Gordon-Burnham Battery Company, New York City, and that all goods manufactured by either concern will be handled in any quantities direct from the office of the latter-named company.

A LARGE CONSIGNMENT OF ENCLOSED ARC LAMPS has been put on the market by Messrs. Rossiter, MacGovern & Co., New York City. The lamps are of the Manhattan direct-current constant-potential, 100-hour type, and are offered at very reasonable figures for an article as much in demand at the present time as are the enclosed arc lamps.

FALL TRADE.—Mr. Charles Wirt, Philadelphia, Pa., reports that the fall trade has made an early start as compared with other years, and that the average size of orders for switchboard instruments, rheostats, dynamo brushes, portable instruments, etc., is larger than usual. The increased demand, he thinks, is the result of economies practiced during the past hard times.

AN ENCLOSED ARC LAMP for series circuits, which the Adams-Bagnall Electric Company is making, is finding favor with the users of this class of lamps. One concern, after giving seventy-five of them a trial, ordered 175 more. Like all A-B enclosed arc lamps, the enclosed globe is made with only one opening, which prevents any circulation of the air taking place. Both terminals of the arc are carried through the one opening.

A TURBINE WATER WHEEL direct connected to a direct-current generator, has been put on the market by Messrs. J. H. Bunnell & Co., New York City. This power unit weighs 15 pounds, and measures about 7 x 8 x 8 inches. Its maximum output is 2 amperes at 10 volts. For charging bicycle lights, storage batteries, running electric fans, and so forth, it is a handy instrument. It is arranged to be coupled to any standard screw faucet.

TWO LARGE DAMPERS.—The Rodney and Ainslie Street stations of the Municipal Electric Light Company of Brooklyn, N. Y., have been recently fitted with automatic damper regulators by Thompson & Bushnell, of New York City. The dampers are each 6 by 8 feet in size, and of such inertia that a 5-32 steel cable was broken in regulating them. The Thompson & Bushnell regulator, with its hydraulic-power cylinder and differential valve, controls the dampers as perfectly as though their dimensions were inches instead of feet.

TRADE CATALOGUES WANTED.—The American Catalogue Bureau of Cleveland, Ohio, which was recently organized, will about October 1 next open free libraries and bureaus of business information in the most important cities in this country and abroad, where the general public may gain much valuable information concerning all lines of manufacturing. When fully organized the American Catalogue Bureau intends to keep permanently upon file all the leading publications devoted to the interests of the various trades, and to this end it requests all manufacturers to mail to it one of their recent catalogues.

VACUUM GOVERNOR.—Warren Webster & Co., Camden, N. J., have just issued a leaflet describing a new automatic vacuum governor, which is the latest improvement of the Webster system of steam heating. The purpose of the device is to automatically control the speed of the vacuum pump or exhaust apparatus for the maintenance of a pre-determined amount of vacuum, which in the Webster system of steam heating is maintained throughout the return pipes. The operation of the device is entirely automatic and positive and is claimed to be economical in its results, representing a large return upon the investment.

STEAM HEATING INSTALLATIONS.—Among the recent contracts received by Warren Webster & Co., Camden, N. J., for the installation of the Webster system of steam heating, are the following: South Park Commissioners, Chicago, Ill., propagating houses, conservatory, office building, etc.; The Home, Denver, Col.; State University Buildings, Bloomington, Ind.; Capital Construction Company, apartment, Washington, D. C.; Turkish Bath Department, Southern Hotel, St. Louis, Mo.; Kahn's Sons & Co., Washington, D. C.; Gulf, Colorado & Santa Fé Railway Company, depot and office building, Galveston, Tex.; Iowa State Hospital, Iowa City, Ia.; Bannigan Rubber Company, Providence, R. I.

ARTISTIC CATALOGUE.—No doubt an artisticaly designed and executed catalogue makes a favorable impression, and as a rule a fine production of this nature is an indication that the business to which it relates is prosperous. The catalogue just issued by the Ball & Wood Company, New York, has a handsomely embossed cover of wine-color card, and the reading matter is fully descriptive of the well-known automatic cut-off steam engines made by this company. Each type of machine is described in detail and illustrated complete and in parts. The method of testing for regulation is also described, and tables giving data relating to the various types of engines made by the Ball & Wood Company are presented. The catalogue is oblong, 9 x 12 inches in size. It is printed on fine plate paper, and the illustrations are excellent productions of the engraver's art.

IMPROVING BUSINESS conditions are reported from every direction, and there is an evident better feeling throughout the trade with reference to the outlook. The Electric Protection Company, Philadelphia, Pa., is one of the fortunate concerns that are experiencing this hopeful change in affairs and reports that new inquiries are being received every day regarding its switches. These inquiries, moreover, are coming from all sections of the country, and during the past two months its largest orders have been shipped West, as far as the Pacific Coast. The company's city trade is also reported to be very good. This company manufactures Stevens flush switches, and carries on a general electrical business. The officers are Charles M. Swain, president; Wm. H. Dresher, treasurer; Wm. Carley, secretary, and Frank Stevens, superintendent.

NEW INTERIOR CONDUIT FITTINGS have been developed so rapidly lately that it is difficult to keep track of them. A line of stamped steel outlet and junction boxes has been put on the market by the Brewster Engineering Company, New York City. The boxes are rendered very convenient by having conduit holes punched in them in every position that a conduit is likely to reach and then having these holes plugged up again, and rendered air tight. When a box is used a few sharp blows from a hammer opens the holes needed for the particular position the conduit is to occupy. Thus a box with ten conduit holes may be used with any one or more of the ten, without bothering to seal up those not needed. The Brewster Engineering Company also makes steel slate-lined panel boxes, steel cut out and switch boxes, and a complete line of wrought steel fittings for conduit work.

NEW ENAMEL FOR LAMPS.—Most incandescent lamps with colored bulbs suffer a great loss of candle-power through absorption in the coloring matter. A new enamel has been put on the market by Messrs. Stanley & Patterson, New York City, which gives a remarkably strong, brilliant colored light. It is called the Bohemian glass enamel, and is put up in wide-mouthed jars, in which an incandescent lamp can be dipped with minimum trouble. The jars are fitted with a screw cover and air-tight gasket, which prevents evaporation of the enamel when not in use. Lamps dipped in this enamel resemble perfectly the real colored glass so far as the senses of sight and feeling can determine. Messrs. Stanley & Patterson have also a new iron-box bell called the "Faraday." It has all the new importations, such as the pivoted armature, back adjustment, platinum contacts, and so forth; but is of such a simple design and is made in such quantities that it can compete with any in price.

FOREIGN ORDERS FOR ELECTRICAL APPARATUS.—Mr. Campbell Scott, of the C & C Electric Company, of New York and Garwood, N. J., informed a representative of The Electrical World that the company is now receiving almost daily some very satisfactory orders from foreign countries for its apparatus. During the last week it has received in addition to the large car-works generator and motor equipment for Japan, which was mentioned in the last issue of The Electrical World, orders from South Africa, Central America and South America, and additional orders from Japan. These orders embrace a large number of machines of various types and capacities, and include several direct-connected engine-dynamo combinations. The C & C Company, it seems, is making preparations to run its extensive works at Garwood night and day, in order to keep pace with the daily increasing volume of orders. The company reports a most flattering demand for its new types of slow-speed generators and enclosed ironclad motors.

DYNAMO DRIVEN BY GAS ENGINES.—The New York State Military Academy has lately installed for the lighting of its buildings at Corwall on the Hudson a gas-engine dynamo plant. The engine is a 15-hp Fairbanks, Morse & Co.'s machine, and was supplied by Messrs. Patterson, Gottfried & Hunter, New York City. It is belted to a 9-kw dynamo made by the Gibbs Electric Company, Milwaukee, Wis. The plant has been so much of a success that it is to be duplicated and the lighting system extended. A curious instance of electric transmission of power is that at the home of Col. J. J. Riker, in Portchester, N. Y., where a Fairbanks, Morse & Co.'s gasoline engine is used to drive a cream separator in a model dairy. In order to remove the engine to a sufficient distance to eliminate any possibility of the odor of the engine reaching the dairy apparatus, the power is transmitted electrically from a dynamo in the engine room to a motor in the dairy.

"DO YOU USE MACHINE BELTING?" If so, consult the new catalogue just issued by the Shultz Belting Company, St. Louis, Mo., and you will learn a great deal about first-class leather belts. This book is full of useful general information for engineers and belt users. The special information contained refers to the Shultz well-known patent sable rawhide belting. This belting is largely used by electric any power companies. Among the claims made for this product by its manufacturers are that it transmits a large percentage of power, is more durable and pliable, runs true and straight, is unaffected by atmospheric changes and has a maximum of strength. The Shultz woven-leather link belt is also described and illustrated. These belts are also well known to electrical machinists and engineers, and are peculiar in that both sides are alike, either one of which can be run next to the pulley. It follows, therefore, that when one side becomes worn the belt can be turned over. At the end of the catalogue are given several excellent testimonials from users of Shultz belts, from which it is evident that the belts are giving the best of satisfaction. Mr. A. B. Laurence, New York manager of the company, will be pleased to send a copy of the catalogue to anyone interested in the subject of belts.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

THE KLONDYKE GOLD FIELDS are now attracting the attention of the whole world, and the results of placer and quartz mining are fully equal to the finds of nuggets in the early California days, and extraordinary inducements are being offered to prospectors, practical miners and investors. By next spring the gold fever will have taken possession of thousands of people, and the Western roads will have all they can do to transport the fortune hunters. The Chicago, Milwaukee & St. Paul Railway and its connecting lines offer the best facilities for reaching the Alaska gold regions. For further information, address E. F. Richardson, Gen. Agt. Pass. Dept., 381 Broadway, New York.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED AUGUST 10, 1897.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

587,693. SIGNAL RECEIVING APPARATUS; W. F. Banks, Milford, Conn. App. Filed Oct. 1, 1896. In a signal-receiving apparatus the combination of a signal-receiving magnet short circuited when the apparatus is at rest, a magnet for controlling the short circuit of the said receiving magnet, and a retarding device for governing the action of the last-named magnet on the contact, whereby certain signals only will be allowed to manifest themselves in the receiving magnet.

587,698. APPARATUS FOR DETECTING ELECTROLYSIS IN UNDERGROUND PIPES AND LOCATING TRANSMISSION LOSSES; H. P. Brown, New York, N. Y. App. filed Jan. 27, 1896. The apparatus for detecting electrolysis in underground pipes and of locating electrical transmission losses, consisting in the combination with the trolley wire, the rail and the underground pipe of a portable switchboard furnished with three or more voltmeters and switches and connections whereby one of said voltmeters may be put in circuit between the trolley wire and the rail, a second between the trolley wire and the underground pipe, and a third between the rail and pipe, the third voltmeter being arranged so that it can be kept in circuit while either or both the other voltmeters are in circuit.

587,700. TELEPHONE BOOTH; E. B. Cadwell, Jamestown, N. Y. App. filed Oct. 22, 1896. A telephone booth having sides with double walls distanced by wooden blocks and interposed sound-deadening material between the blocks and the walls.

587,720. ELECTRIC RAILWAY SYSTEM; S. D. Field, Stockbridge, Mass. App. filed Nov. 21, 1891. In an electric railway system, the combination with a slotted circuit embodying metal frames, of insulators flexibly mounted on arms projecting from said frames, and a working conductor composed of magnetic metal flexibly suspended from said insulators.

587,733. ELECTRIC CONTROLLER; S. Harris, Johnstown, Pa. App. filed Jan. 7, 1897. In an electric controller, in combination, a rotatable drum carrying a plurality of contacts, and a coil surrounding a part of said drum and electricaly connected to any suitable part of the circuit..

587,740. TROLLEY WIRE HANGER AND SPLICER; C. K. King, Mansfield, Ohio, App. filed April 13, 1897. The combination with a hanger or splicer for suspended trolley wires, whereby the contacting surface of the wire is continuously exposed, of means adapted to pass through the splicer or hanger, and wire for securing the same together in efficient electric connection.

587,746. SWITCH BOX; J. C. Mock, Wilkinsburg, Pa. App. filed June 10, 1896. In a switch box, the combination of a movable cam adapted to be operated by the movable rails of a switch, a lever arranged to be shifted by said cam in one direction, a spring acting on the lever in opposition to the cam, and contact springs adapted to form parts of a track circuit to be moved into and out of contact with each other by the lever.

587,750. ELECTRIC ARC LAMP; J. McLaughlin, Chicago, Ill. App. filed Aug. 26, 1895. In an arc lamp, the combination with the main magnet or solenoid, of a shunt magnet or solenoid, an intermediate centrally pivoted connecting lever between the cores of the said magnets, a carbon rod, a clutch and a clutch lever extended from said clutch and connected to the intermediate lever, the main magnet or solenoid being adapted to move independently of the intermediate mechanism along its core into a suspended position whereby it constitutes a weight against the resisting influence of which the shunt magnet acts in the feeding of the carbon.

587,764. WIRE FOR ARMATURE WINDING; S. H. Short, Cleveland, Ohio. App. filed March 19, 1896. A conductor for use in winding armatures and similar appliances comprising a plurality of wires, the adjacent contact-surfaces of which conform in cross section to the interstices between such wires and thereby fill such interstices.

587,765. ARMATURE FOR DYNAMO ELECTRIC MACHINES; S. H. Short, Cleveland, Ohio. App. filed March 29, 1897. A plate or lamination for armature cores, having the ends thereof beveled to lines radial to the armature centre, the outer edge curved to the circumference of a circle struck from the centre of the armature, and the inner edge straight.

587,769. ELECTRIC MOTOR; J. L. Thoma, Kansas City, Mo. App. filed Aug. 17, 1896. An electric motor, comprising a circular casing, a top plate closing the upper end of the same, and provided with a series of insulated holes or openings, a shaft journaled in the bottom of the casing and in said top plate, a circular series of field coils suspended from the top plate within the casing and having their upper ends extending through said insulated holes or openings, a commutator mounted upon said top plate and surrounding said shaft and provided with a series of pins which are connected to said ends of the field coils, a conducting annulus in the bottom of the casing electrically connected to the opposite ends of said field coils, a conductor from the source of supply connected to said annulus and extending through the casing, an armature mounted rigidly upon said shaft within the casing and below the field coils, an armature mounted upon said shaft above the commutator and provided with depending pins having their lower ends contiguous to the upper ends of the field coils, studs depending also from said armatures, brushes carried thereby and engaging the commutator at the upper side of said armature, and a collecting brush engaging the same and electrically connected to the source of electrical supply.

587,792. ELECTRIC RAILWAY; R. L. Caldwell, Cleveland, Ohio. App. filed Jan. 21, 1897. The combination of the main overhead conductor and a branch conductor in substantially the same approximately horizontal plane, except that said branch conductor is curved downward below said plane near to their point of convergence, with a trailing trolley arm, a contact-device carried thereby, said contact device having end flanges and a groove between said flanges, and having its surface between said flanges, and groove constructed whereby, as it is drawn along in contact with a conductor, it will be caused to move endwise until its groove engages with said conductor.

587,798. ELECTRIC METER; J. F. DeBauw, Brussels, Belgium. App. filed April 26, 1897. In an electric meter, the combination of a solenoid or bobbin, which has a hollow core and through which passes a shunt current from the main current, a current interrupter for rendering this current intermittent, a soft iron armature, one end of which enters the hollow centre of the bobbin, a flexible rod suitably supported and attached to the other end of the armature, and a spring pawl fitted to the said flexible rod, a ratchet wheel engaged by said pawl, a shaft carrying the ratchet wheel, a spring controlling said shaft, the entire arrangement being such that the passage of the current in the bobbin produces a to-and-fro movement of the armature and of the flexible rod, whose pawl, each time the armature is attracted by the bobbin, causes ohe ratchet wheel to partly rotate, thereby producing a proportionate tension in the spring coiled round the said shaft.

587,805. TROLLEY HANGER; T. Fletcher, St. Louis, Mo. App. filed Oct. 10, 1896. The combination of a conductor or trolley wire, a flexible strand or wire, means for connecting it to the trolley wire at each end and a suspending device, the flexible strand having a loose connection with said suspending device whereby the strand may move freely upon the suspending device at the point of connection in response to the vibrations of the trolley wire.

587,818. LIGHTNING ARRESTER; E. M. Hewlett, Schenectady, N. Y. App. filed March 16, 1897. In a lightning arrester, the combination of arcing electrodes, a non-inductive resistance in circuit with one of the electrodes, and a blow-out magnet having the ends of its coil orcoils connected to the non-inductive resistance at points between which there is a difference of potential due to the dynamo current following a lightning discharge.

587,822. AUTOMATIC ELECTRICAL REGULATING DEVICE; E. W. G. C. Hoffmann, Charlottenburg, and J. H. F. Gorges, Berlin, Germany. App. filed April 17, 1896. In an electric regulating device, the combination with an element having a reciprocating movement, of a regulating arm or lever, and the regulating arm, whereby motion is imparted thereto, and the de- an electromagnetic clutch adapted to connect the reciprocating element sired regulation is accomplished, and means for actuating the said clutch at either extreme of the stroke of said reciprocating element.

587,829. PROCESS OF TREATING ALLOYS FOR MANUFACTURING ELECTRODES; L. P. Hulin, Modane, France. App. filed Dec. 21, 1894. The process of producing electrodes of spongy metal, which consists in 1897. A contact device for induction coils, comprising a pair of fixed termi- alloying a heavy metal such as lead with barium, and thereupon treating the alloy with a liquid to eliminate the barium and thereby produce a spongy electrode.

587,838. CIRCUIT BREAKER; H. Lemp, Lynn, Mass. App. filed April 3, nals, a bridge normally held in contact with the fixed terminals by a spring, and a rheotome hammer for opening the contacts.

587,868. COMMUTATOR AND LEAD; S. H. Short, Cleveland, Ohio. App. filed March 12, 1897. In a commutator a hub, commutator bars and alternate insulating plates arranged around the same, said bars and plates having a rabbeted surface at one end, in combination with an insulating ring, which is fitted to said rabbeted surface, and has at its inner edge an outwardly turned flange and at its outer edge an inwardly turned flange, the outwardly turned flange covering the end of the commutator bars, and a clamp engaging said ring and holding it and the commutator bars in position.

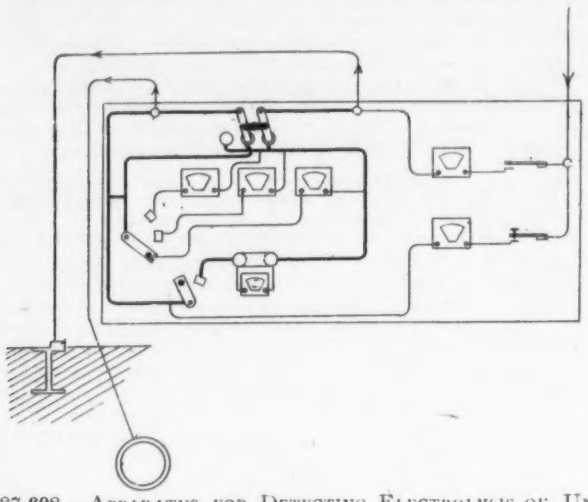
587,869. FIELD MAGNET FOR DYNAMO ELECTRIC MACHINES; S. H. Short, Cleveland, Ohio. App. filed March 12, 1897. The process of making field magnets for dynamo electric machinery consisting of taking magnet-cores with slots extending from one end, damming said slots with sand or other yielding substance, placing the cores in a mold with the slotted ends projecting into a space provided for the yoke and casting the yoke in such space, whereby the yoke embraces the magnet cores, and in cooling compresses the cores toward their slots, thus preventing abnormal strains.

587,870. TROLLEY; S. H. Short, Cleveland, Ohio, App. filed Feb. 16, 1897. In a trolley, the combination of the trolley arm, its forks, which converge at their upper ends, and the curved and tapering fork ends which are secured to and form parts of the forks, said fork ends having at their upper ends vertical plates, which plates at their top and front edges are cylindrical in form, and are continuations of corresponding surfaces of the fork ends, with a shaft secured to said plates, and a flangeless roller rotatably mounted upon the shaft and being at its ends of the same radius as the cylindrical parts of said plates.

587,871. ARMATURE; S. H. Short, Cleveland, Ohio. App. filed March 13, 1897. In an armature, the combination with a slotted core, of an end ring at each end of the core having peripheries adapted to support the armature inductors beyond the core, insulating covering surrounding said peripheries and protecting the inductors from them, and troughs of insulating material in the core slots, said troughs projecting beyond the core.

587,883. DEVICE FOR EXAMINING JEWELS BY RONTGEN RAYS; E. Thomson, Swampscott, Mass. App. filed Sept. 4, 1896. An apparatus for facilitating the examination of jewels by Röntgen rays, consisting of means for producing the rays, a support for the jewel, opaque to light, but transparent to the Röntgen rays, a fluorescent screen for converting the Röntgen rays into light after the passage through the jewel, a mirror for reflecting the rays, and eye pieces for examining the reflected image.

587,921. APPARATUS FOR GENERATING CONSTANT ELECTRICAL CURRENTS; C. N. Black, New Haven, Conn. App. filed April 26, 1897. In an apparatus for generating a constant electric current, the combination

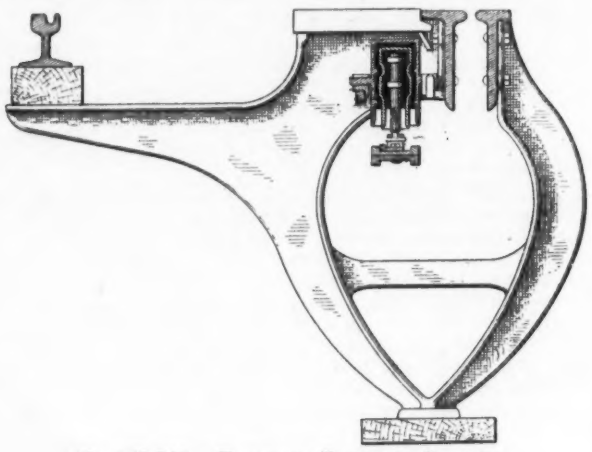


No. 587,698.—Apparatus for Detecting Electrolysis of Underground Pipes and Locating Transmission Losses.

with a steam engine having a fixed point of cut off; of a constant-current dynamo connected upon the multicircuit plan; that is to say, with its working or distributing circuits connected in series with and between its independent armature circuits, translating devices located in the said working or distributing circuits and arranged in series, and an automatic steam cut off constructed and arranged to cut the steam off from the engine when the same exceeds its rated speed.

587,931. BURGLAR ALARM; C. Coleman, Chicago, Ill. App. filed Jan. 11, 1897. In an electrical barrier, the combination with a plurality of parallel insulating strips, of a plurality of parallel conducting strips secured to the insulating strips and arranged so as to overlap.

587,937. REGULATING ELECTRIC MOTORS; A. G. Davis, Washington, D. C. App. filed Nov. 17, 1896. The method of converting the electrical energy of alternating current into mechanical motion, which consists in setting up thereby in the primary member of a motor a field of force, inducing



No. 587,720.—Electric Railway System.

thereby in a secondary member a secondary current of lower frequency than the original current, neutralizing by a phase-advancing device part or all of the lag of the secondary current, and transmitting said current to a motor whose rotor is mechanically connected to the rotor of the first motor.

587,998. ELECTRO-PNEUMATIC ALARM; G. W. MacKenzie, Beaver, Pa. App. filed April 15, 1897. A draft tube, a diaphragm within the tube, a supporting rod, electromagnets in proximity to the rod for attracting the rod magnetically when the magnets are energized by a current established by contact with the rod, and an alarm device in circuit with the magnets.

588,004. ELECTRIC ALARM; R. Penney, National Military Home, Ohio. App. filed Jan. 2, 1897. In an electric alarm the combination with a suitable standard, a hollow resonator, a helix rigidly held on an arm centrally within said resonator, iron vibratory points held centrally within said helix and normally in contact with the inner surface of said resonator by the action of an intermediate spiral spring, and an electric circuit through the device.

588,021. MEANS FOR CONTROLLING ELECTRIC MOTORS; S. H. Short, Cleveland, Ohio. App. filed May 7, 1896. The combination with an elevator and a driving-electric motor, of a controlling-electric motor constructed and adapted to generate counter E. M. F. in the circuit of the driving motor, a brake for controlling the rotation of the armature of the controlling motor and vary the counter E. M. F. generated therein for effecting the starting and stopping of the driving motor, a switch for cutting the controlling motor out of circuit, and connections between the brake and switch and the elevator, whereby the operator can manually operate said brake and switch from his position in the elevator.

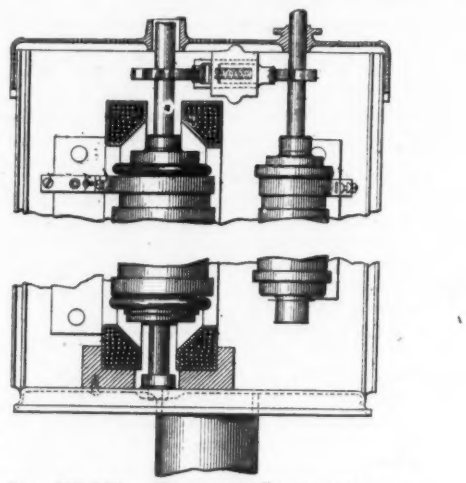
588,046. PRINTING TELEGRAPH; E. M. D. Andre, Meru, France. App. filed Oct. 1, 1896. A printing telegraph instrument capable of being used either as a transmitter or as a receiver, said instrument comprising a type disc, a series of keys carried by a disc, which rotates in unison with the type disc, a driven train of gears to revolve said discs, electrically controlled means for releasing said train of gears and a switch and stop lever, operated by a projected key upon the disc carrying keys.

588,048. INSULATOR FOR WIRES; G. Ashby, Hamilton, Canada. App. filed Dec. 24, 1896. An insulator consisting of a stem provided with an arm having a lug, a bolt connected with said stem, and a cylindrical piece mounted upon said bolt.

588,053. OVERHEAD TROLLEY SYSTEM FOR ELECTRIC RAILWAYS; S. H. Cauffiel, Johnstown, Pa. App. filed July 24, 1896. In a system of electric conductors, a structure for cross-line wire, consisting of intersecting arms having spans and pivoted self-sustained bars forming part of two of said arms, the said bars lying at right angles and having their free ends lying close to the point of intersection.

588,097. ELECTRIC RAILWAY SYSTEM; L. E. Walkins, Springfield, Mass. App. filed April 15, 1897. In an electric railway system in combination, the usual track-rail and third-rail section separated at intervals by insulating material, a generator or source of electrical energy and a line wire, a contact provided to correspond to each third-rail section, and a switch to unite them, a wire running from the feed wire to the one contact, and a wire running from the contact to the adjacent third-rail section; a second set of contacts and a switch for uniting them, an electromagnet in proximity to the two pairs of contacts for each section and an armature therefor, electric wires running from the contacts to the electromagnet adjacent to the group of contacts for the section next in advance, comprising in their course a battery or the like; a movable device provided at each third-rail section actuated by the wheel of a passing car, and in turn operating to set the switches against the contacts, the armature for the adjacent electromagnet having a locking engagement with said switch-actuating movable part to hold the switches closed until released by the circuit through the electromagnet as the car passes onto an advanced third-rail section.

588,104. ELECTRIC LOCOMOTIVE; R. Eickemeyer, Dec'd, R. Eickemeyer, executor, Yonkers, N. Y. App. filed May 9, 1892. In an electric-locomotive organization the combination of a wheeled truck; a lever frame having two parallel sides, hinged at their ends to two end pieces, and forming a substantially rectangular parallelogram, which is located centrally with reference to the wheels and their axles; suitable brake shoes, with brake beams for the two pairs of wheels; flexibly jointed links coupling the sides of said frame to the brake beams; and means (as chains and hand brake levers) con-



No. 587,733.—Electric Controller.

nected with the sides of said frame at opposite points, for enabling a car driver to change the form of said lever frame, and to thereby force the brake beams with the shoes into braking contact with the tread faces of the wheels, said braking mechanism affording central space beneath a car and between the axles, available for the reception of apparatus essential to the locomotive.

588,111. CURRENT-COLLECTING DEVICE FOR ELECTRIC RAILWAYS; R. M. Hunter, Philadelphia, Pa. App. filed Feb. 4, 1897. In a trolley, the combination of a support jointed to the car at the bottom, and having a guide at the top adapted to travel along the under side of the suspended conductor, combined with a current-collecting roller journaled upon an upright axis and arranged close to the side of the guide and electrically insulated from it, whereby the contact is made with the conductor immediately in the vicinity of the guide.